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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

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GRASSES AND CLOVERS FOR HILL COUNTRY.

(3.) Poa Pratensis.

POA PRATENSIS is very widely distributed over the hill country in New Zealand, but the writer knows of no large areas where this grass has ever become a dominant. It occupies a peculiar position really, holding out under many extremes of conditions, and yet under no particular conditions applicable to hill country are there found high-yielding, pure Poa pratensis pastures. On certain lowland cropping-areas—such as loose, rich river-silts—Poa pratensis may become exceedingly prolific, and when these areas are uncultivated for a year or so quite high-yielding pastures of this grass may result. On such soils Poa pratensis is generally called "twitch" or "couch," and is ranked as a bad weed.

Poa pratensis is a demander of rather loose soil conditions and fairly high fertility. As far as its fertility requirement is concerned the writer ranks it along with cocksfoot (Fig. 76). In unconsolidated hill lands—volcanic, pumice, limestone, or rubbly greywacke soils—Poa pratensis, when sown, will almost invariably be found as a subdominant in the pasture, and the amount of feed it produces on such soils is proportional to the fertility of those soils and to the competition presented by other grasses and clovers with which it is associated.

These two factors really govern to what extent Poa pratensis will become dominant. The grass demands rather a high standard of soil-fertility in order to thrive at all well, but given this condition, in a mixed sward, cocksfoot, white clover, and perennial rye-grass particularly will easily beat Poa pratensis in production of herbage, and consequently it will be well subdued in such an association. Further, the more consolidated and the more fertile a soil becomes the lesser the place Poa pratensis occupies in that pasture. If the first of the botanical analyses recorded on page 303 of the May issue of the *Journal* is referred to one will see a very fair state of affairs concerning Poa pratensis in a consolidated, highly fertile soil. Here approximately 77 per cent. of the herbage of the pasture is perennial rye-grass, cocksfoot, and white clover, and Poa pratensis occupies only $2\frac{1}{2}$ per cent.

of the pasture herbage. This pasture is on a rather loose volcanic soil type, which, when ploughed, sown down to crop, and then left a year in fallow, runs predominantly to Poa pratensis.

On soils less consolidated than that of the pasture referred to, and on poorer soils where cocksfoot is failing, and where there is a weak, rather open association, Poa pratensis in general is forming between 5 per cent. and 10 per cent. of the pasture sward, as shown in the analyses at the foot of page 303 and on page 305 of the same *Journal*. Poa pratensis in a weak association of this sort has ample scope to perform better if it were capable of doing so on such soils. The limiting factor to greater production from it on these soils seems to be a matter of soil-fertility, and, as before stated, as soon as the fertility is sufficiently

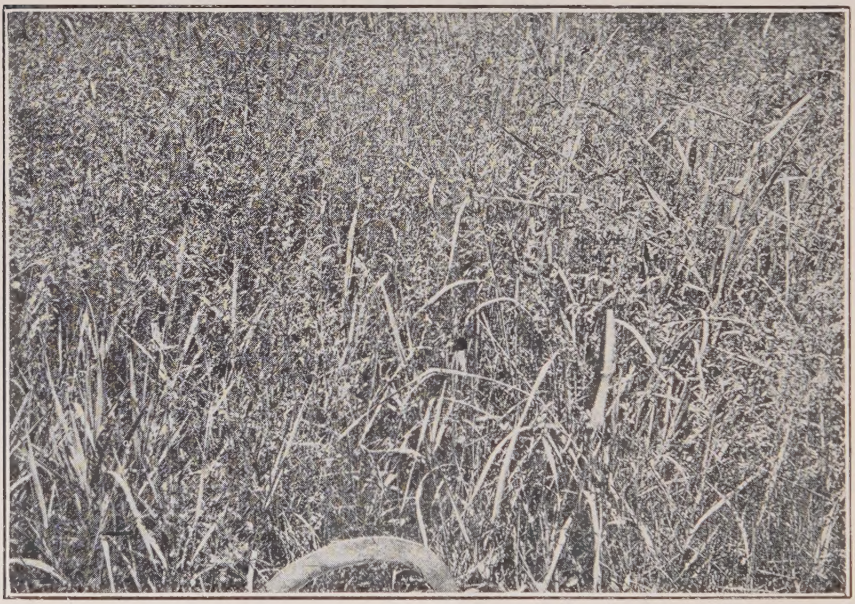


FIG. 76. POA PRATENSIS ASSOCIATED WITH COCKSFOOT.

This sward is on country that has been spelled for a time, and where the soil-fertility was not sufficient for rye-grass to thrive.

[*Photo by E. Bruce Levy.*

improved to grow vigorous Poa pratensis this grass is smothered out by cocksfoot, perennial rye-grass, and white clover.

From what has been said regarding the fertility requirement of Poa pratensis it is, as one would expect, on that hill country where cocksfoot is reasonably strong that Poa pratensis is seen to best advantage. Poa pratensis is quite a good shade-endurer, and consequently can persist for quite a long while on hill country even though the cocksfoot may periodically get away rank. Continual spelling of the cocksfoot, however, kills out Poa pratensis, though the latter is about the last of the associate species to go.

The conditions that will enable a certain amount of white clover to grow along with the Poa pratensis, cocksfoot, &c. (Fig. 77), are just

about ideal to keep the ground surface completely covered with pasture herbage of these species. When white clover goes out, and when cocksfoot begins to yellow and get stunted, Poa pratensis also diminishes greatly in yield. The underground stems tiller much more sparsely —perhaps only one weak shoot being sent up instead of some half dozen or so under more highly fertile conditions. This lessening of the number of the tillering shoots and general reduction in their size result in a weak pasture association that is open to weed or inferior grass invasion (Fig. 78).

With the exception of a few large areas—such as much of the Rangitikei County, the southern part of the Wanganui River area, and the limestone country of Hawke's Bay and the Wairarapa—it is only on isolated aspects of the general hill country that Poa pratensis has not dwindled to such an extent that the entry into the sward of brown-top, Danthonia pilosa, ratstail, &c., has been made possible. This, in the writer's opinion, is where Poa pratensis, like cocksfoot and rye-grass, has failed as a feed-producer on so much of the hill country.

On stabilized sandhills and on hill country near the sea (Fig. 79) where there is a looseness in the soil from blown sands, &c., Poa pratensis associates quite well as a subdominant in Danthonia pilosa-dominant pastures on these soil-types. The yield from the Poa pratensis, however, is small, excepting in the damper sand-hollows, sand-plains, and other slightly richer and damper spots, in which places Poa pratensis does make appreciable growth, beating, in fact, Danthonia pilosa on these particular aspects. When collecting for the field plots at the recent New Zealand and South Seas Exhibition, what were seemingly almost pure danthonia-dominant turfs were collected from the hill country at Henley, and when these were placed in position and watered well there was in four or five weeks' time in certain turfs almost a complete alteration in pasture dominance, the spindly Poa pratensis that was associated with the danthonia making such rapid growth as to easily outstride the danthonia.

On the limestone hills of Hawke's Bay, where the fertility is high and the soil-texture loose—for example, the hills round Waipukurau—Poa pratensis does exceedingly well, associating in about equal proportions with somewhat short-growing rye-grass, cocksfoot, white clover, and crested dogstail, and with danthonia on the somewhat drier ridges and sunnier aspects. On almost the whole of the Hawke's Bay coastal country, past Wairoa, and farther up the coast beyond Gisborne, Poa pratensis is strongly represented in the pasture turf—increasing in growth and dominance up to a point where the fertility is moderately high, and decreasing in dominance almost to extinction as the country runs more and more into danthonia dominant.

Throughout the Taranaki hill country, on the somewhat loose-textured volcanic soils with which most of the hills are covered, Poa pratensis is general, but, as already indicated, throws little feed and does not form anything like a close and continuous turf. An exception is on certain of the better rubbly, blue-papa country, where this grass does throw quite good feed and covers well. South of the Wanganui River, across to Mangaweka, Taihape, and Hunterville, Poa pratensis does exceptionally well, associating with cocksfoot, rye-grass, white clover, and crested dogstail.

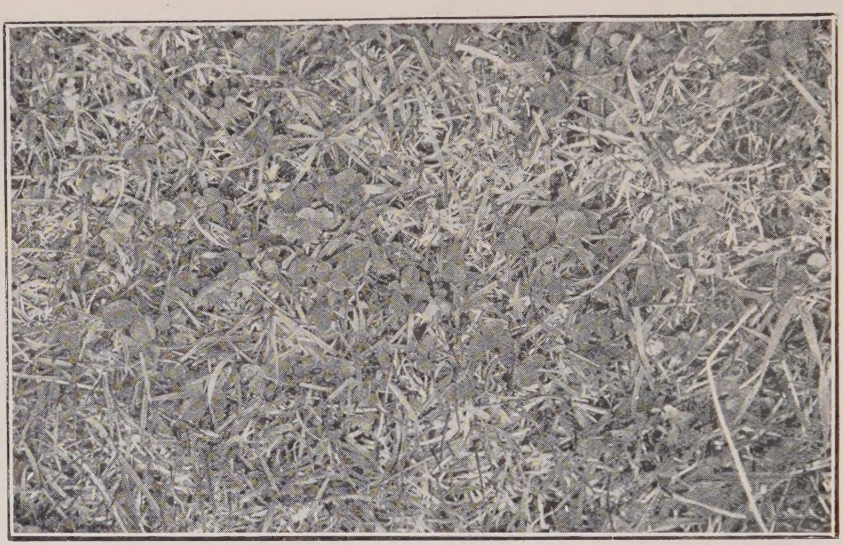


FIG. 77. POA PRATENSIS ASSOCIATED WITH WHITE CLOVER AND COCKSFOOT.

Under these conditions Poa pratensis yields quite highly as an associate species. On steep country that is inclined to crumble away the binding effect of Poa pratensis is very valuable. (Compare with Fig. 80.)

FIG. 78. POA PRATENSIS (ON RIGHT) WEAKENING AND OPENING UP AS A REDUCTION IN THE FERTILITY OF THE SOIL TAKES PLACE.

On the left brown-top is coming in and filling up the ground bared by the dwindling of the Poa pratensis.

[*Photos by E. Bruce Levy.*

Excepting on the hard stiff clays, it would be difficult to imagine Poa pratensis not existing in one form or another in any hill-country pasture-turf. As the writer has tried to indicate, its significance as a pasture species is almost entirely governed by two factors—the texture of the soil, and the amount of plant-food available in that soil. The fact that the fertility requirement of Poa pratensis is so high limits its value to a very great extent, for when conditions are suitable in this respect it is only on certain loose, rubbly natured soils that Poa pratensis is necessary in the turf, better grasses like rye-grass, cocksfoot, crested dogstail, and white clover being quite reliable on such soils to form the pasture sward. However, one must not lose sight of the value on the loose friable soils of Poa pratensis as a binding element that will keep the turf compact to stay any surface erosion so common on steep country (Fig. 77).

Poa pratensis is valuable in a purely mechanical way on hill country which is of a rubbly nature or of so loose a nature that tussock-forming species, such as cocksfoot, rye-grass, and crested dogstail, become so exposed by the soil breaking away from their crowns and washing down the slope as to make the persistence of these grasses most precarious (Fig. 80). By the binding effect of the Poa pratensis this surface soil erosion is largely overcome, and hence the maintenance of a sward containing tussock-forming grasses is much more certain than where these are sown without the binding, turf-forming Poa pratensis. The underground spreading growth-form is of vital importance on hill country, not only from its binding effect, but also from the fact that the spread over difficult places where establishment of seed is almost impossible is able to be accomplished by plants that have this underground root and crown system strongly developed.

Poa pratensis, in common with all underground creeping stemmed or short underground tillering crowned grasses, is liable when it has completely covered the ground surface and when no further ground is open for colonization by the plant to become what is commonly termed "sod-bound." As a matter of fact, the sod-bound state is the outcome of the exhaustion of all plant-food from that soil within reach of the grass-plant. While the plant was spreading out into new zones it was tapping fresh plant-food supplies, but these all having been tapped and the supply exhausted the plant dwindles in size because it is starved.

Under no conditions in New Zealand does there seem to be any difficulty in regard to the utilization of Poa pratensis, and in this the species can certainly be credited with a high palatability throughout the entire range of its growing-period. The writer is inclined to think, however, that the yield of Poa pratensis is never so high as to demand any special care on the part of the farmer to ensure its full utilization.

Summing up, one finds that Poa pratensis is essentially a grass of loose-textured soils, and requires for its satisfactory growth quite a high soil-fertility. On highly fertile soils, particularly where loose-textured conditions prevail and where surface erosion is bad, the presence of Poa pratensis among the rye-grass, cocksfoot, crested dogstail, and white clover serves admirably as a binding element to keep the sole firm and compact. Besides this mechanical service in

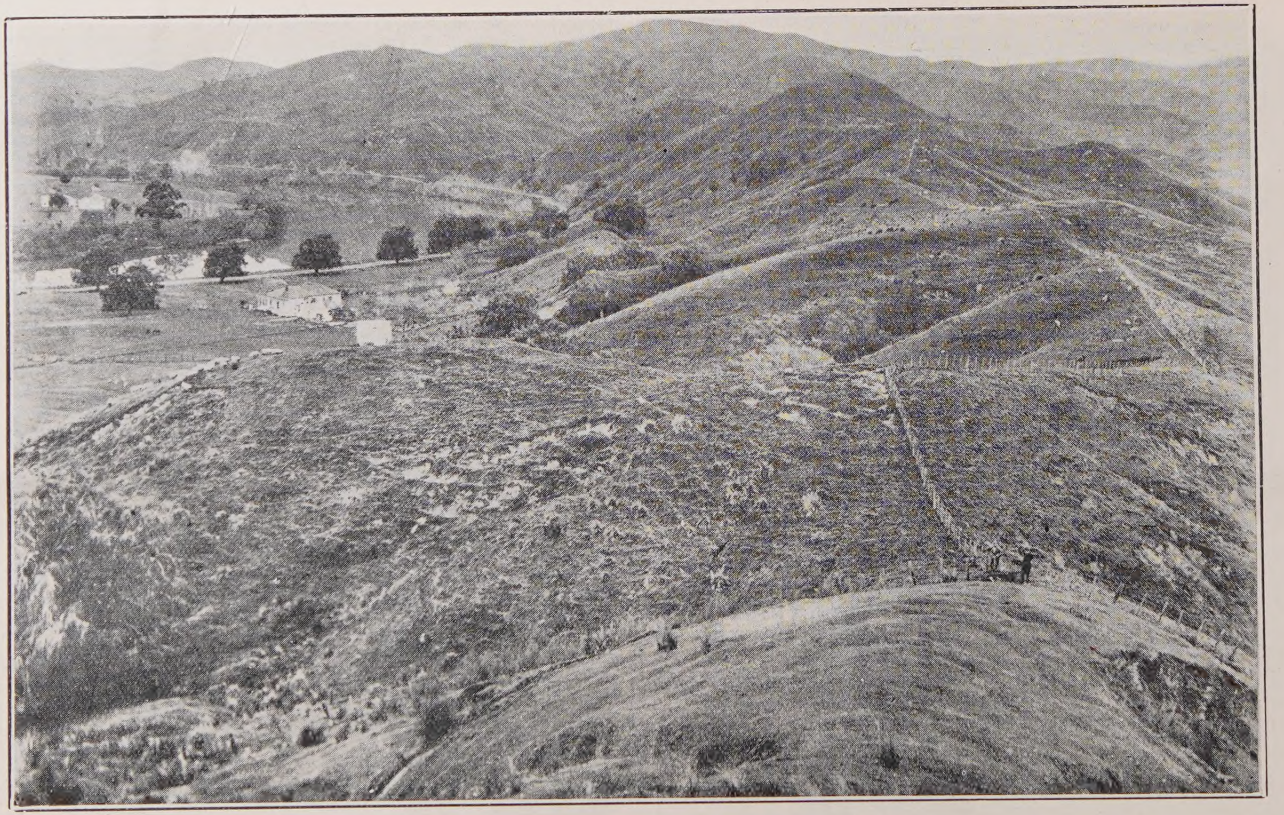


FIG. 79. TYPICAL COASTAL HILL COUNTRY IN HAWKE'S BAY (WAIROA).

Here Poa pratensis remains permanent in the sward and yields quite well, particularly so on the damper and slightly more fertile aspects. [*Photo by E. Bruce Levy.*

the sward, Poa pratensis functions as a producer of a fair amount of highly palatable herbage. On soils that are poor and hard, running to brown-top, Danthonia pilosa, ratstail, &c., Poa pratensis is of comparatively little value, and no reliance can be placed upon it to ward off any one of these grasses from becoming dominant just so soon as the soil conditions have become hard or infertile. As a matter of fact, when cocksfoot begins to decline and white clover to fade out of the pasture Poa pratensis will likewise dwindle, persisting in the sward as a short-leaved, sparse-foliaged plant, tillering at distant intervals with one or two small tillers to each shoot, a weak, open, low-productive pasture being then presented (Fig. 81).

FIG. 80. TURF ON HILL COUNTRY CRUMBLING AWAY.

The crumbling-away of the ground surface seen here has placed the tussock-forming grasses—cocksfoot, rye-grass, crested dogstail, &c.—in a most precarious position. On such aspects Poa pratensis as a binding element in the sward would have largely prevented this erosion. (Compare with Fig. 77.)

[*Photo by E. Bruce Levy.*

POA PRATENSIS UNDER SHADY SECONDARY-GROWTH CONDITIONS.

Poa pratensis is one of the best shade-enduring grasses we have, and will persist for many years in moderately dense shade. Its crown being well below the ground surface enables the secondary growth to be fired with no injury to the grass itself. The removal of shade and letting in of light, together with the stimulating effect of the ash remaining, cause quite an appreciable and rapid production of new Poa pratensis growth (Fig. 82), and if only the soil conditions were such to enable a rapid permanent growth and cover from this grass it would prove invaluable from the point of view of control of the secondary growth. Unfortunately, the renewed growth seldom keeps going sufficiently strongly to produce much of a cover, and later so little feed is thrown that the number of stock enticed to work among the

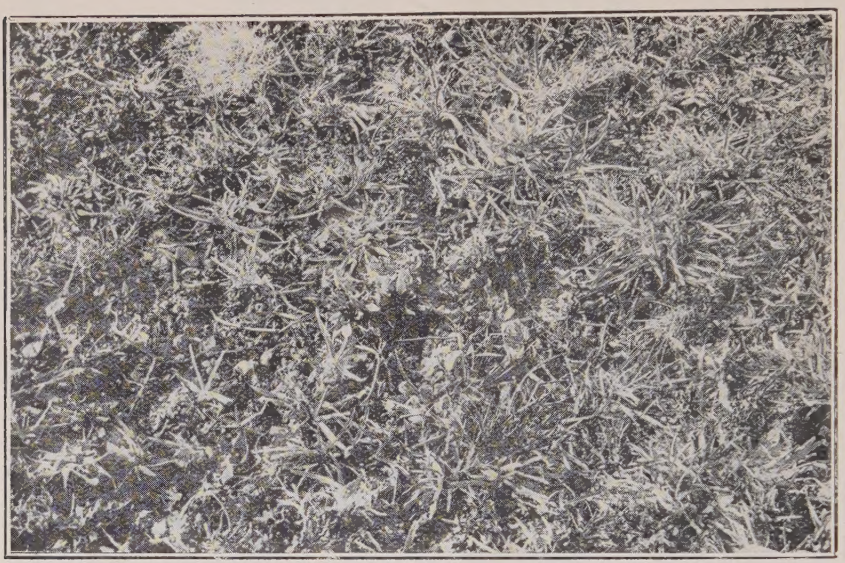


FIG. 81. COCKSFOOT AND POA PRATENSIS ASSOCIATION ON INFERTILE HILL COUNTRY.

The predominant grass showing is Poa pratensis, with a few cocksfoot-plants on the right. Note the isolated shoots of Poa pratensis showing little or no tendency to tiller. The contraction in size of the shoots and lack of tillering results in a very open association and low-production pastures.

FIG. 82. POA PRATENSIS RECOVERING AFTER A SECONDARY-GROWTH (BLACKBERRY) BURN.

If there could be introduced into blackberry and other forms of secondary growth grasses that recover rapidly after fire and tiller out strongly to make a good tight sward the problem of secondary growth would be largely overcome. Poa pratensis promises well for a start, but under infertile soil conditions fails to keep going.

[*Photos by E. Bruce Levy*

fern, &c., when this is reappearing is so small that the fern has more or less an unchecked return. Still, no doubt, even what amount of growth is formed is of some value, and it must be borne in mind that this growth is secured by no more expenditure than what it cost to clear the area by fire.

POA PRATENSIS IN PRIMARY AND SECONDARY BURNS.

On first-class hill country Poa pratensis certainly should be included in the primary forest burn as an associate species for the better grasses and clovers which are essentially of a tussocky nature. While these are persisting and growing well Poa pratensis also will thrive. The grass is rather a slow establisher from seed, and it is not until the main flush of the rye-grass growth wanes—generally in the second or third year—that much sign of Poa pratensis is to be observed. During this time, however, the plant will have formed underground creeping-stems, and as soon as the cover of the other grasses weakens somewhat it will spread fairly rapidly, particularly so in the looser situations. As has been said earlier, however, Poa pratensis is really of no more value than rye-grass or cocksfoot on the poorer and harder slopes of the burn. If it does establish and persist on such places it will throw practically no feed.

From the investigational work done already on the typical primary forest burn in Whangamomona County it would appear to be an open question whether the inclusion of Poa pratensis in the mixture is economically sound there. On that and similar country, wherever there is a good amount of kamahi, hinau, rewarewa, totara, or beech in the forest, it would seem essential to include brown-top in the mixture. Brown-top will do all that Poa pratensis can do, and it can be established much more cheaply and rapidly. One must bear in mind, however, that Poa pratensis does at least linger on most hill country, and may be expected to produce a certain amount of feed even on the worst of soils. Again, its persistence among secondary growth, and its return on the clearing-off of that growth, favour the inclusion of seed of this grass in the original mixture sown. An amount of 1 lb. to 2 lb. per acre is sufficient.

On the best-quality hill-country soils—blue papa, rubbly papa, and limestone formation—2 lb. of Poa pratensis should be included in the mixture. This practically is the only binding grass necessary to put on these soils, particularly so under good stock-management and top-dressing to keep the soil-fertility up to a high standard. Unfortunately, areas of this soil-type in standing forest remaining to be felled and grassed are comparatively small.

As far as the secondary burn is concerned—and particularly where there still persists within the secondary growth certain vestiges of Poa pratensis—the inclusion of more seed of this grass in the mixture is not recommended. In the writer's opinion one may accept this view in regard to secondary-growth country: that the high-fertility-demanding grasses must have failed on such country after being well established from the original seeding made on the primary burn, or else secondary growth would most assuredly not have got the upper hand. If these species failed after getting so good a start, how much less likely are they to succeed on the secondary burn, where conditions for

establishment and growth are infinitely harder. As far as the experimental sowings on secondary-growth burns in Whangamomona County are concerned, one can say fairly definitely that the money spent in Poa pratensis seed has been almost certainly a waste. In the last two seasons' sowings in that district Poa pratensis has not been included in the mixtures owing to the extremely poor showing it made in the previous sowings. Therefore, the inclusion of Poa pratensis in secondary-growth burns, unless on an exceptionally fertile piece of country, is not recommended.

PARALYSIS IN PIGS.

Paper read by C. V. DAVUS, M.R.C.V.S., Veterinarian, Department of Agriculture, Hamilton, at the annual meeting of the New Zealand Veterinary Association, Wellington, July, 1926.

No one will doubt the common occurrence of the condition of paralysis among pigs in certain localities in the Dominion, and the frequent inquiries concerning it. On looking through a recent number of the *New Zealand Journal of Agriculture* I noticed an inquiry from a farmer as follows: "My young pigs, about five weeks old, are developing what we call 'staggers' pretty badly. They are going in the hind quarters, but otherwise appear quite healthy. I would be pleased if you could advise me of a remedy for this complaint." How familiar every veterinarian must be with such an inquiry!

Paralysis in pigs is a common condition. That which concerns us most is the condition occurring in young pigs, but it may occur in all breeds of swine regardless of age or physical condition. It usually involves the hind legs, but in some instances the front ones are also affected. The disease is of considerable economic importance, because if preventive measures are not taken and pigs affected are not properly treated the trouble becomes chronic, complications arise, the animals will not develop properly, and it is not uncommon in such cases for a large percentage of deaths to occur.

CAUSES OF THE DISEASE.

I propose to deal first with some of the causes of the disease, both alleged and probable.

A contributory cause of some importance is inbreeding, which, if persisted in, will result in weakly, ill-developed, deformed pigs. Instances have been advanced where pigs from one particular boar have a tendency to be affected. The dangers of continued inbreeding can be eliminated by outcrossing and culling out of all breeding-animals in which a notable proportion of offspring continue to develop paralysis. Too few of our farmers take the necessary interest in the breeds and breeding of their pigs. It does not take one long to appreciate this fact when visiting a farm where a large number of pigs are kept.

Tuberculosis of the vertebral column may be a cause in some cases. Where the lesions are characteristic of tuberculosis the vertebræ—chiefly the dorsal vertebræ—become involved, a rarefying ostitis is set up, with consequent interference with the spinal cord.

Parasitic invasion may be accountable, and special mention must be made of the so-called kidney-worm, *Stephanurus dentatum (Sclerostomum pinguicola)*. This parasite is a nematode worm closely related to the sclerostomes. The male averages 1 in. in length, and the female 1½ in. It has sometimes been found in the kidney and liver substance, and less frequently in the spinal cord. It more commonly occurs in small cysts in the fat surrounding the abdominal viscera, especially in the perirenal fat. The kidney-worm has been described as being responsible for a variety of symptoms, such as stiffness and paralysis of the hind limbs. But, on the other hand, the parasite has been frequently met with in swine in large numbers without having produced any appreciable symptoms. When pigs have died from some disease, infestation with this parasite has probably been coincident. It is certainly difficult to understand what harm it can do, with the possible exception of an accidental case when it is found in the spinal cord. So far as is known, only one such parasite has ever been found in New Zealand, or has ever come under official notice here.

Another cause in some instances is the use of concrete for flooring in pigsties. It is now well known, I think, that no animal will thrive lying in contact with a concrete floor. I personally knew a noted Friesian breeder in England who built a new cowhouse to house one hundred cows, with a concrete floor. Six months later the whole flooring was broken up and relaid with bricks, owing to the cows becoming stiff with rheumatism and arthritis.

The kind of flooring for a pigsty has frequently been discussed, and it is admitted concrete is desirable, as it can be so easily drained and well cleaned. But it is essential that a wooden floor raised on trestles be put down where the pigs are lying, and plenty of clean, dry bedding on top of the wood. There must be an appreciable air-space between the wood and the concrete floor.

In individual cases there is always the possibility of injuries to the back, involving the spinal cord, being the cause of the paralysis trouble.

At the commencement of this paper I quoted a common inquiry from a farmer in the *Journal of Agriculture*, and the following is a portion of the reply, in the same *Journal*, by the Live-stock Division: "This 'staggery' and paralytic condition in pigs is frequently met with, and is believed to arise through errors in diet, coupled very often with bad housing-conditions. . . . Continual feeding on sour milk or skim-milk alone is a common cause of digestive derangement. . . ."

There is no doubt in my mind that this answer is appreciably correct. But I personally believe that the condition in young pigs is very largely due to rickets, all factors indicated in the answer being contributory. This condition of rickets is a disease characterized by diminished calcification in the bones. Predisposing causes are bad housing, bad drainage, bad ventilation, lack of exercise and sunlight, and errors in breeding and feeding. The condition is more prevalent in some localities than others, and seems to prevail more extensively during some years than in others.

In recent years the cause of some deficiency diseases has been ascribed to the absence of accessory food factors known as vitamins. In the case of rickets the fat-soluble vitamin is absent. Recent investigations have shown that there is much more chance of swine suffering from a lack of the fat-soluble vitamin—especially swine kept

solely in sties—than there is in the case of horses, cattle, and sheep. This is principally due to lack of roughage and pasture-feeding.

It has been found that animals fed on foods from which all substances of a fatty nature had been removed could not live. The addition of fats such as palmitine, stearine, and olein—the most common plant and animal fats—gave good results. The addition of crude fats such as butter also gave good results. Commercial olive-oil or cotton-seed oil caused no improvement; therefore fat was not lacking, but some substance soluble in fats. This substance is called vitamin A or fat-soluble vitamin.

In New Zealand whole milk is rarely fed to pigs on account of its value. The one mainstay is skim-milk. The pigs get little roughage except when at pasture. The skim-milk from up-to-date modern centrifugal separators contains considerably less than 0·1 per cent. of fat, whereas cow's whole milk contains an average of about 3·9 per cent., and sow's milk is higher still, being about 4·8 per cent. It is absolutely necessary to endeavour to replace the amount of fat taken from skim-milk. I have in mind one place near Hamilton where a farmer has over five hundred pigs of all breeds, and they are getting products from a boiling-down works which contain a good amount of animal fat. Conditions of paralysis among the pigs are unknown on this place.

Mr. H. R. Denize, Inspector of Stock, Thames, has provided me with several instances in which the trouble has to a large extent been overcome on farms where at one time it was very prevalent. I quote one instance he gives: "The pasture was broken up and a crop of soft turnips put in, with superphosphate and basic slag, 3 cwt. to the acre, these fertilizers providing certain mineral elements. After the turnips were taken out the paddock was put down in grass again. The pigs then had plenty of roughage, and clean skim-milk not more than twelve hours old was also fed, with the addition of fat in the form of boiled animal offal." Mr. Denize also gives me an interesting example of a wild sow which was perfectly right and healthy when captured, but which later developed paralysis after being on the same diet of skim-milk and under the not very sanitary conditions as other domestic pigs already suffering from the disease.

SYMPTOMS.

I do not propose to dwell long in describing the symptoms of the disease; they are too well known to all of us. Generally the first symptoms noticed are disturbances in locomotion; the affected animal may be hopelessly stiff in movement, stagger and wobble, and finally fall to the ground. In other instances the pigs may be down and unable to rise; others are often sitting on their haunches and unable to rise up on the hind legs.

The disease is generally of a chronic nature, and continues for months unless death intervenes. It is frequently common in young pigs just after weaning, or even while still suckling. After the disease has continued for some time the muscles of the affected portions become tense and hard. At autopsy gastritis is frequently observed.

TREATMENT.

The question of treatment seems to me to be chiefly one involving general swine-husbandry, rather than a purely veterinary one, though

perhaps it is difficult to know where the one ends and the other begins.

Taking the causes, whether predisposing or actual, there are perhaps five main essentials in successful swine-husbandry: (1) Breeding; (2) housing; (3) drainage; (4) equipment; and (5) feeding. These points will be taken seriatim.

(1.) As I have already said, far more attention could be paid in this country to the breeding of swine, thus rendering the general constitution of the progeny more capable of withstanding disease. Continued inbreeding should be avoided, as this gives rise to weakly and deformed progeny. The selection of a breed is more particularly the choice of the individual breeder, and is more or less governed by the market demand, but the essentials to be desired are good feeding-qualities, early maturity, and prolific females.

(2.) Housing affords another opportunity for considerable improvement among farmers. The location can be determined only by consideration of the prevailing winds, drainage, and arrangements of other farm buildings. There should be freedom from dampness, and good ventilation without draughts. It is necessary for recently farrowed pigs to be kept dry and warm, and provision made for them to have plenty of exercise.

(3.) Proper drainage is equally important. There are many places where no consideration at all is given to this subject. It often happens that the lowest and most boggy and swampy site is selected. Possibly it cannot be used for anything else, so a piggery is made of it. Instead of this, the site should be selected high and dry in order to ensure good drainage. The wallow so frequently met with serves no useful or ornamental purpose, but provides a ready means for the propagation of infective agents. Better is it in every way and from every point of view to pasture pigs where possible.

(4.) Little attention is paid to the important matter of thoroughly cleansing all utensils and equipment used in the handling and feeding of swine. It is of paramount importance to keep everything associated with pig breeding and feeding in as sanitary a condition as possible. Farmers who fail with pigs can attribute their failure largely to a lack of this essential detail. All swill-tubs, milk-receptacles, feeding-troughs, milk-cans, milking-machines, and separators, &c., should be kept thoroughly clean, and scalded regularly with boiling water. The skim-milk pump and carrying-pipe so frequently found in use cannot be sufficiently condemned.

(5.) To further quote the reply given to the inquiry in the *Journal of Agriculture* by the Live-stock Division: "Continual feeding on sour milk or skim-milk alone is a common cause of digestive derangement. . . . The milk should be supplemented with boiled roots and pollard, or some equivalent meal or grain." By far the commonest foods for pigs in New Zealand are the dairy by-products—skim-milk, buttermilk, and whey. But there is no doubt that pigs fed on skim-milk alone, without pasture or equivalent grain or roughage, often fail to thrive, and animals thus affected become lame and crippled, and in severe cases become permanently stunted.

For maintenance certain elements of food are necessary. These elements must not only be of a certain quantity, but must be of a certain quality. Nitrogenous foods are used in repair and growth;

non-nitrogenous—which are largely carbohydrates and fats—are the source of energy, and the portion not consumed is stored as fat. The usual inorganic foods are water and salts, and are removed in secretions and excretions.

Mother's milk is unquestionably the diet of young animals. In the case of sow's milk there is apparently considerable variation in the quantity and quality. The following tabulation shows average analyses and ratio of sow's milk, cow's milk, and skim-milk :—

	Water. %	Albumen. %	Fat. %	Sugar. %	Ash. %	Ratio.
Sow ..	84·6	6·3	4.8	3·4	0·9	1 : 2·2
Cow ..	87·0	3·7	3·9	4·7	0·7	1 : 3·6
Skim-milk ..	90·0	3·6	0·05	4·9	0·6	1 : 5·6

Sow's milk naturally has much more fat than skim-milk. Young pigs sometimes break down after weaning, and sometimes while still on the mother. The milk of the mother depends upon her diet ; if that is deficient it is probable that her own milk is also deficient.

Skim-milk is one of the best and cheapest protein foods for swine ; buttermilk is of about equal value ; whey has been found to be worth about half as much. To make the ration balanced, however, it is necessary to increase the fat and fat-soluble vitamin content. Fortunately, the green portion of plants such as lucerne, &c., carrots, and sweet potatoes, also beef fat and cod-liver oil, have been found rich in this vitamin. In some parts of the country roots—turnips and mangolds—are grown as bulk food. Potatoes, pumpkins, artichokes, bran, pollard, and linseed-meal, &c., are all used to substitute the dairy by-product food, and are essential to make up the fat-deficiency. When pastured properly for some period of the year pigs should be found free from paralysis due to rickets. Pigs at pasture should be rung to prevent rooting.

Great controversy has frequently arisen as to when is the best stage for feeding skim-milk to pigs. It is the generally accepted rule that it should be fed fresh, but just twelve hours old, allowing enough time for gas to leave it. But a very important point, I think, is that pigs fed on sour milk should always be fed on it, and *vice versa*. Alternating of sour and fresh milk in feeding is likely to set up the greater digestive disturbance.

Probably the chief mineral deficiency is calcium, which can be supplied very cheaply by using finely ground limestone, chalk, or wood-ashes. Phosphates can be replaced by steamed bone-meal.

From the medicinal point of view it is usual to advise the farmer to give a dose of castor-oil with the food, and afterwards, daily, a teaspoonful of bicarbonate of soda to each pig, also in the food.

Great benefit would also be derived by the addition of cod-liver oil to skim-milk—say, two teaspoonfuls per pig—to pigs just weaned, in the morning and evening feed. Moreover, the oil could be used as a preventive in places where the disease has occurred. I understand that best Norwegian cod-liver oil could be supplied at less than 11s. per gallon, so the cost would be immaterial. The application of medicinal agents to pigs other than in food is not the easiest of tasks.

The main course in combating paralysis in pigs is the education of the farmer in correctives—such as hygiene and practical economic feeding—for what is a common but admittedly deficient diet.

RAGWORT (*Senecio Jacobaea*) AND ITS RELATION TO WINTON DISEASE.

ESMOND ATKINSON, Biological Laboratory, Wellington.

THE present article is intended to give a general account of ragwort as a weed, and to sum up what is known about it and its relation to hepatic cirrhosis, or "Winton disease." Much experimental work has been done in this direction in New Zealand and in other countries, and a number of reports have been published, but it has not hitherto been easy, except with the aid of numbers of reference-books, even to look through all the evidence collected. With the idea of making this evidence as convincing as possible, actual quotations have as a rule been made here from the more interesting of the reports on the various experiments, observations, &c., connected with the disease.

HISTORY OF RAGWORT IN NEW ZEALAND.

Ragwort is a native of the whole of Europe and the west of Asia, except the extreme north of these countries. It is particularly common in Britain, and is looked on as a native there also, but in all other parts of the world it is regarded as an introduced plant. G. M. Thomson ("The Naturalization of Animals and Plants in New Zealand") states that he cannot find any earlier record of it in this country than 1874, when he discovered it growing near Dunedin; but it rapidly increased in Southland, and in Auckland, Taranaki, and Wellington, and is now abundant in a great many parts of both Islands, though it is not evenly distributed throughout the Dominion. Ragwort was placed on the Third Schedule of the Noxious Weeds Act, 1908 (noxious weeds where so declared by local authority), but in the Noxious Weeds Amendment Act, 1910, it was transferred to the Second Schedule, which includes four plants to be considered as noxious under all circumstances—namely, blackberry, Canadian or Californian thistle (*Cnicus arvensis*), sweetbrier (*Rosa rubiginosa*), and ragwort or ragweed (*Senecio Jacobaea*).

DESCRIPTION OF THE PLANT.

Ragwort is a perennial herb springing from a thick rootstock with abundant shallow roots. There is no tendency in the rootstock to creep, and this means that one plant is not capable of forming a large patch like Californian thistle, for example. This fact is of importance in considering the different ways of getting rid of the weed from an infested area.

The stems are stiff, upright, and not much branched below, and reach a height of 4 ft. or so. They are strongly furrowed, but this is not always conspicuous, as they are very thickly clothed with leaves. The leaves are what is known as pinnatifid—that is, so deeply cut as almost to be compound, the segments in the case of ragwort being themselves crisped and deeply cut along the edges and strongly overlapping, while those at the tip of the leaf are united together to form one segment much bigger than any of the others. In colour the leaves are dark green above and rather paler below. Some spring from the roots and have quite long stalks; others spring from the stem, and

FIG. 1. RAGWORT (SENECIO JACOBAEA).

(*a*) Root and base of root leaves; (*b*) flowering-stalk; (*c*) outline of root leaf. All natural size.

[*Drawing by Esmond Atkinson.*

these upper ones have no stalks but clasp the stem closely. There is a wide range of variation in the outline, &c., of the root leaves on different plants. If two extremes are taken, it is very hard to believe that both can really belong to ragwort. Some plants are smooth and hairless, while others are more or less clothed with cottony hairs, particularly under the leaves and where they join the stems.

In the flowering season (which lasts normally from February to April, though it may be much longer) the stems branch very much above, the flower-heads being arranged in what are called corymbs —large clusters in which the flower-stalks spring from different heights on the stem—but are all cut off at the same level, and consequently form a flat-topped bunch (Fig. 1). The flower-heads are about $\frac{3}{4}$ in. in diameter, bright yellow in colour, and with from ten to fifteen conspicuous spreading rays. The involucre or cup underneath the flower-head is made up of narrow green bracts (scale-like leaves) with black tips. The achenes or "seeds" are of two kinds in each head—those from the ray florets being smooth, much curved, and angled in section, while those from the disc or centre are hairy, straight, and nearly round in section.

There is really no other weed of roadsides or of pastures with which ragwort could be confused. There are one or two native Senecios which are a little like it in some ways, but these are only to be found in situations that are quite different in character.

POSITION AS A WEED.

Ragwort is negligible as a weed of arable land, as it is not capable of surviving continuous cultivation; neither is it to be feared in first-class grazing-country where a close permanent turf can be maintained. It has been pointed out that the root-system is not an aggressive one, although a plant cut off at the ground-level is capable of regrowth; but, on the other hand, the seed-dispersal system is an extremely aggressive one. The inflorescence is very well developed (heavily infested ragwort country is a blaze of yellow in the summer), the "seeds" are small, and the pappus or down large in proportion. The weed is most dangerous in country where the soil is comparatively light, and where there is a tendency for the turf to break up in the summer, leaving open spaces ready to receive the seed as it falls. Top-dressing under such circumstances is worse than useless as a means of control.

From what has been said it will be seen that the chief means of spread of the plant has been through the agency of the wind from one area to more or less closely adjoining ones, though the seed sometimes occurs as an impurity in lines of agricultural seeds, a small amount being found, for instance, in southern Lotus major.

RELATION OF RAGWORT TO HEPATIC CIRRHOSIS IN CATTLE, HORSES, AND SHEEP.

In some old English herbals ragwort is called "staggerwort" or "stammerwort"—names which are at least suggestive of the plant's not being entirely innocuous when eaten. In his "Principles and Practice of Veterinary Medicine," Professor Williams described cases of what he called "stomach staggers" in horses, in which many of the

symptoms appear very much like those that have since been met with in Winton disease. He says that the disease "raged in the south-west of England and Wales in 1800 and 1819, the summers of which were hot and dry, prevailing most commonly amongst horses in low, wet pastures where the grass was rank. It was supposed to arise from their eating ragwort or staggerwort (*Senecio Jacobaea*), but of this there is no absolute proof."

In Canada a disease of cattle very similar to Winton disease in New Zealand had been known for many years previous to 1903, when experiments were carried out (inspired evidently by Gilruth's work in New Zealand) to discover its cause. The result of these experiments was that the trouble was considered to be definitely due to the eating of ragwort, and the disease, which was formerly classed as contagious, was removed from a list of affections dealt with under the Animals Contagious Diseases Act. Four experiments were carried out :—

(1.) To learn if this disease is contagious through the medium of infected stables. The evidence from this experiment was entirely against the idea of the disease being a contagious one.

(2.) To decide whether the disease is caused by the ingestion of ragwort (*Senecio Jacobaea*). Sixteen young animals housed in a new stable were tested with various amounts of the weed, and three of these died of typical "Pictou cattle-disease" (as it is called in Canada) in less than a year.

(3.) To ascertain if the feeding of ragwort (cured by itself) would produce the disease. Two healthy young animals were used. One was fed twice daily on chopped ragwort with very little bran, and died of the disease in eight months. The other, which was kept as a control, remained healthy.

(4.) A contact experiment, to ascertain whether the disease is contagious by direct contact with animals affected with the malady. After three months the animals experimented on were in good health and fine condition.

In South Africa a complaint exists known locally as "Molteno cattle-disease." Experiments were carried out (in this case also apparently as a result of the successful New Zealand ones) and showed a South African plant (*Senecio Burchelli*), allied to ragwort, to be the cause of the trouble.

A disease having the symptoms of hepatic cirrhosis has been reported from a number of States of America, and from Germany and Great Britain.

HEPATIC CIRRHOSIS IN NEW ZEALAND.

In 1903 Gilruth reported that for at least twenty years the disease had been known as the most deadly one attacking horses in Southland. A full account was given by him at this time of the symptoms in horses and cattle, a few of the more marked ones in the case of the former being a weak, staggering, swaying gait, yellowness of visible mucous membranes, dark urine, and sometimes frenzy followed by unconsciousness. In cattle one of the first symptoms is a diminution of the milk-supply and an acrid flavour of the milk, making it useless for butter; others

FIG. 2. GRASSLAND BADLY INFESTED WITH RAGWORT. [*Photo by E. Bruce Levy.*

are a peculiar odour of the skin, rapid emaciation, and chronic diarrhœa. Both horses and cattle show, post-mortem, yellow bile-stained tissues, and the liver almost always in a state of chronic cirrhosis.

Ragwort was long suspected as a cause of the disease, but the earlier experiments seemed not to confirm this, and attention was diverted from the plant for a time. Exhaustive experiments were made to test if a living organism was the cause. Gilruth says regarding them: "All the experiments were abortive so far as any pathological results were concerned, and it was consequently considered that, taken in conjunction with previous experiments, they effectively disposed of the possibility of the cause of these cases of hepatic cirrhosis being due to any bacteria or other organisms to be found in the liver or the alimentary tract."

On the occasion of the Auckland outbreak of 1901 attention was forcibly called to ragwort, which was particularly abundant that year on the block where the disease showed itself, and the presence of which was most marked in two other disease-infested places—Southland and Nova Scotia—almost the only thing common to three widely differing farming-areas. Suggested by this fact, a series of experiments was carried out:—

(1.) Two well-grown six-month calves were fed on a daily ration of 6 lb. ragwort, 2 lb. bran, 2 lb. chaffed oaten sheaves. Feeding began on 31st March, 1902, and continued till 17th April, when the calves grew dull and sleepy-looking, and were turned out on turnips and young oats. No. 1 died on 27th April; No. 2, on 29th. Cirrhotic liver was shown to be present in both cases.

(2.) Two cows and a horse were fed for three months on chaff made from naturally dead ragwort, one cow being given 1 lb., the second 2 lb., and the horse ¾ lb. per day—in all cases mixed with other fodder. After three months the cow fed on 2 lb. per day was killed and examined, and proved quite normal. The horse and the other cow were still so a year later.

(3.) To test the effect of green ragwort on stock a 5-acre paddock was fenced in on the Hanga Block, between Okoroire and Tauranga, and horses, cattle, and sheep put on it. The paddock was thickly infested with ragwort, which had previously been eaten off by sheep. First some cattle died, then a horse, the sheep escaping. The livers were forwarded for examination and all showed symptoms of cirrhosis.

(4.) An aged light gelding was fed on oaten chaff and on sun-dried ragwort made into chaff, besides a liberal supply of good hay. The feeding continued from 1st July to 22nd September, 93 lb. being given altogether. The horse died on 24th September with all the symptoms of the disease.

It was at about this time that the administration of strychnine was first found beneficial, though only temporarily so.

EFFECT OF RAGWORT ON SHEEP.

The statement was made by Gilruth that sheep could resist the action of the *Senecio* poison to an indefinitely greater extent than cattle or horses. During the period that the horse used in the foregoing experiment No. 4 was being fed at the laboratory two sheep received daily (as well as their food ration) ½ lb. of the same supply

of ragwort as that given to the horse. At the end of six months the sheep were slaughtered, and a careful post-mortem examination was made. The liver and other internal organs were found in both cases to be perfectly healthy to the naked eye, and a subsequent microscopical examination failed to disclose any abnormality. Frequent opportunities offered themselves, and were made use of, of microscopically examining the livers of sheep depastured on ragwort country, but no marked pathological changes were seen.

A flock of 2,000 sheep was put twice on to ragwort, with an interval of three months between. The mob was taken off the second time on account of marked mortality, some showing while they were still on the weed, but the greatest after they had been removed from it. The most noticeable symptom was this yellow colour, the affected animals being referred to as "yellow sheep." The conclusions arrived at were that sheep can eat ragwort daily without harm (with very few exceptions) if it does not monopolize the soil, and if there is not too much they will check and even ultimately eradicate it. The reasons for the comparative immunity of sheep are supposed to be (1) that the plant is actually less toxic than in the case of horses and cattle, and (2) that owing to their small mouths the sheep can pick and choose to a very much greater extent when grazing.

GILRUTH'S CONCLUSIONS.

Gilruth concluded an exhaustive report on "Hepatic Cirrhosis affecting Horses and Cattle (so-called Winton Disease)," published in the Annual Report of the New Zealand Department of Agriculture for 1902-3, as follows:—

A careful consideration of the whole of the facts at our disposal, I submit, can only lead to one conclusion—viz., that *Senecio Jacobaea* is the cause of the disease (hepatic cirrhosis). In this, as in so many other matters, what now seems to have been the obvious was ignored; not without reason. That this common plant was known to exist, and had been known to exist without detriment, so far as was apparent or at least recognized, to stock; that sheep ate the weed with apparent fondness and evident impunity; that no one could ever say he had observed horses or cattle partake of the plant when growing naturally; that it was patent to the most casual observer these animals avoided its ingestion, even when it was almost impossible to do so; and that Mr. Park's experiment in Southland, so far as it went, resulted negatively (although slaughter and post-mortem were never made). All these facts tended to divert the mind from the true cause. In addition, when it is considered that the most experienced and highly trained pathologists in Canada had decided that ragwort was not the cause of the Pictou disease—identical with that known as Winton disease in New Zealand—it was but natural to look for causes more obscure, and withal offering more interest to the investigator.

Yet, when I had, as I believed, exhausted the possible means of demonstrating the cause to be a living organism, I was forced to again turn my attention to the herbage and to the common weed, which alone, as I have shown, was the one point of uniformity in three localities so widely divergent in every other respect as Nova Scotia and the two extremities of the colony of New Zealand. That *Senecio Jacobaea*—commonly known as "ragwort," "ragweed," "stinking Willie," &c.—contains an active principle capable of producing inflammation, more or less chronic according to the dose, in the liver of the horse and the ox is, I venture to submit, definitely proved by the experiments recorded. The fact that this weed was known in the days of Culpeper in certain parts by the terms "staggerwort" and "stammerwort" is extremely interesting.

Every endeavour should be made by the farmer, the local and the General Government of the Colony, to eradicate this weed, which is not only dangerous

to stock by ingestion, but cumbers the land, rendering it almost useless. Cattle and horses are naturally averse to partaking of the plant, but under certain circumstances, such as a paucity of every other fodder, or its presence in hay or chaff, they commence to eat the weed, and it seems most probable a liking is gradually acquired, the taste persisting evidently after the actual necessity for the ingestion of the plant has disappeared.

Palliative treatment has been demonstrated to be of value. Along with careful attention to dietary, strychnine given per mouth or subcutaneously, as I have shown, relieves the acute symptoms of the disease, and renders it possible for an animal's usefulness to continue for several years although affected with a cirrhotic liver. Such treatment is in no way curative as far as the real disease is concerned, and the only really satisfactory course to pursue is prevention by the eradication of the weed . . .

LATER OFFICIAL REPORTS.

The following extracts from later Annual Reports of the Department are added, since they give a clear idea of the present position in regard to ragwort and its relation to hepatic cirrhosis :—

District Superintendent, Dunedin, 1926.

Ragwort Poisoning : In many parts of the district the paddocks are a yellow mass when ragwort is in flower, and there is little doubt that this weed is spreading to a serious extent. A considerable number of cattle, more than we are aware of, also horses, die every year. When grass is plentiful stock do not touch it, but when the grass is scarce the cattle especially commence feeding on it, and evidently acquire a taste for it. On one farm at Edendale thirty-two cows out of a herd of sixty died from the effects of ragwort.

District Superintendent, Dunedin, 1925.

Dietetic Diseases : In the Southland district dietetic troubles are prevalent principally due to osteomalacia, ragwort poisoning, and redwater. I am attaching Mr. W. D. Blair's report, and I quite agree with him that ragwort is responsible for a very large number of deaths amongst cows in Southland, and the same applies to cows in the Owaka district. It is quite evident that unless farmers take some effective measures to destroy this weed several districts will become practically useless for dairying. I recommend that a number of ewes be purchased and put on in the spring ; these by constant nibbling serve to keep the weed in check.

W. D. Blair, Veterinarian, Invercargill, 1925.

During the past year numerous cases were reported by the owners of cows in the dairying districts supposed to be tubercular, but on inspection these were found to be affected with ragwort, and in my opinion this weed causes a greater mortality amongst dairy cows than any other condition. On one property which I visited with the Commissioner of Crown Lands the owner informed us that of about forty cows with which he started dairying about three years ago he had practically lost the lot. One or two animals were noticeably affected on our visit. Inspection of the paddocks created no surprise, as it was seen that the ragwort was there to an extent that made it impossible for an animal to graze without partaking of the weed. A similar state of affairs exists in the paddocks throughout the dairying districts, and until measures are taken by the owners to rid the paddocks of the weed losses will continue. Few cases of the acute form of ragwort poisoning came under notice; practically all the cases assumed the chronic form, the animal gradually wasting away—in other words, becoming a "piner."

District Superintendent, Christchurch, 1925.

Some ragwort poisoning occurred in the West Coast area, and as the farmers there are inclined to look upon such cases as ordinary losses met with in bush areas and do not report them it is difficult to give an estimate of the approximate number lost. However, I am inclined to think that on one dairy farm six cows died during the year from the above cause. I am keeping in touch with this area, and spreading information in regard to prevention of the trouble.

MEANS OF CONTROL OF RAGWORT.

Compared with many weeds ragwort is quite easy to get rid of. It is of no importance on arable land because ordinary tillage methods destroy it completely. An important fact in connection with ragwort is that though the plant is a perennial and will survive a single cutting of the flowering-stems at the level of the ground, the repetition of this for a few years kills the whole plant without the need of grubbing it out by the root. Obviously a weed with such numerous and easily spread seeds must be prevented from producing them, and as it is quite possible for all the plants of ragwort in a paddock to be grubbed out and yet to retain sufficient vitality afterwards to infest the whole of the surrounding country the tops must be destroyed early in the season.

FIG. 3. RAGWORT-SEEDLINGS ESTABLISHED IN A WEAK, OPEN GRASSLAND TURF.
[*Photo by E. Bruce Levy.*

Although sheep are now known to be affected by the ingestion of ragwort in large quantities, the danger to them is slight compared with that to horses and cattle, and they are known to eat the plant—especially the young crown—quite readily, while horses and cattle are believed to acquire a taste for it only after they have accidentally consumed considerable quantities mixed with grass in country highly infested with ragwort.

In the various methods of dealing with ragwort that are quoted it will be seen that all its different peculiarities can be made use of against it, and, however abundant ragwort may be on his property, no one need despair of getting rid of it. The following quotations are mostly from the writings of authorities in the Department, and several of them are actual answers to correspondents who have inquired as to the best

means of dealing with the weed, as published in the *New Zealand Journal of Agriculture* :—

"If the area is not extensive, control by cutting before flowering; repeat two or three times in certain seasons. On large areas sheep in sufficient numbers control it. Sheep should not be on ragwort for more than a month or six weeks, or bad effects will result." "When there are only small patches the plants can be destroyed by heavy spraying with one of the proprietary weed-destroyers. Where the weed is too plentiful for this method it can be kept under by stocking with sheep, provided the land is sufficiently improved to enable it to be stocked to its full carrying-capacity . . ." "When it is not possible to stock well with sheep, try frequent cutting of the young plant before flowering to prevent growth of leaves. If flowering is allowed and the weed then cut down, enough sap will remain in the stem to mature some seed. On small areas pull up or cut below the surface; or cut down, gather, and burn. This must be done in the early flowering stages and not when the seed is mature . . ."

An inquiry by a Norsewood settler and the answers published in the *Journal* may be usefully quoted in full, as follows :—

"Will you kindly let me know," wrote the correspondent, "the best method of eradicating ragwort, which is very prevalent in this district. Most of the settlers pull the plants when in flower. In this case would broken roots left in the ground grow again next season? I notice that when cut off level with the ground the plants spring up again."

The Live-stock Division (Noxious Weeds Inspection) replied: "Where ragwort is pulled it generally grows up again from roots left in the soil, as also happens when the plant is cut off level with the ground. The plant, being a perennial, will grow from the same root for three years. It is thus propagated both by seed and roots. Where it is possible to keep the land well stocked with sheep during the early spring months, when the plant-growth is young and tender, no trouble will be experienced in keeping it in check and eventually in eradicating it. Where the land cannot be altogether given over to sheep, excellent results have been obtained in many parts of the Dominion by grazing a number of old ewes along with the cows on the pastures during the late winter and spring months, these ewes eating the soft crown out of the plant when it first appears. The ewes can then be sold off fat in the summer. When neither of these methods can be adopted, frequent cutting or pulling up immediately before the plants flower will be found effective. The plants will have to be so dealt with for three years, however, before the weed is eradicated from the land. Ragwort is a very free seeder, and if it is allowed to flower and seed the ground will become polluted, and will take at least three years to become thoroughly clean again. In the foregoing it has been assumed that the land in question cannot be cultivated. Cultivation soon suppresses the weed, in spite of its perennial character and free production of seed."

Mention is made in the Annual Report of the Department of Agriculture for 1906–7 that one of its Inspectors in the South Auckland District had noticed that "black caterpillars" destroyed a large number of ragwort-plants. The writer is indebted to Mr. D. Miller,

Entomologist to the Department, for the following note on this insect (and insects generally) as a means of controlling weeds: "It is often suggested that some insect might be made use of as a means of controlling ragwort in New Zealand. The larvæ of the common black and white "magpie moth" (*Nyctemera annulata*)—well known under the name of "woolly bear"—which originally lived on the leaves of several common New Zealand Senecios, is now often seen on ragwort and allied plants such as groundsel (*S. vulgaris*) and German ivy (*S. mikanioides*) as well as on garden cinerarias. The caterpillar is very often extremely abundant on ragwort, which in some parts of the country is quite eaten down by it. In some years the larvæ are much more abundant than in others, this being due to the influence of controlling factors, among which are insect parasites. As a means of controlling ragwort *N. annulata* is not satisfactory. Too much dependence should not be placed upon insects as a control for weeds, and there is a great danger of widespread damage being done to plants of value by the introduction of any allegedly weed-controlling insects."

While the subject of ragwort-eradiction is being dealt with, H. C. Long, "Common Weeds of Farm and Garden" (England), may be quoted. He emphasizes strongly the value of systematic mowing of the plant as a means of destroying it, and states that this method is much used in Canada. He takes the following from McAlpine and Wright ("Transactions, Highland Agricultural Society, 1894"): "The best method is, when cutting off the heads, to leave a sufficient length of the lower part of the stem untouched. In the autumn, when the ground has been softened by rain and the roots have shrunk and hardened, they may be quite easily pulled out by hand."

There is necessarily a certain amount of repetition in the foregoing control methods as given by different authorities, and there are also a few points which appear contradictory, but which have been included without hesitation as it must be obvious that there can be no rule-of-thumb method given for getting rid of a weed which is at home under so many different circumstances.

SHEEP INFESTED WITH LICE.

THIS matter is dealt with by the Director of the Live-stock Division (Mr. J. Lyons) in his annual report for 1925–26 as follows:—

"Sheep affected with lice are still too numerous, and far too many prosecutions for exposing lice-infected sheep at saleyards have had to be taken. It is the general opinion of the Inspectors in the various districts where this trouble is found that it is attributable not so much to a deficient dipping solution as to carelessness in both mixing and dipping. Inquiries from careful sheep-men confirm this, and indicate that where the directions of manufacturers of well-known dips on the market are followed no trouble is experienced. It is legally a punishable offence to expose sheep affected with lice for sale in a public saleyard, and, as the presence of lice can be just as readily ascertained by the owner as by the Inspector who examines them at the yards, it is an unpardonable act of neglect on the owner's part not to take proper precautions to ensure that his sheep are free from lice before taking them to a sale. The Inspector has the power to order the withdrawal of the sheep from sale, and it is a question whether we should not adopt this practice generally, with a view to seeing if any better results will ensue, in place of our present practice of allowing the sheep to be sold subject to immediate dipping, followed by a prosecution."

CONTROL OF BROWN-ROT IN STONE-FRUITS.

RECENT EXPERIMENTS AT HENDERSON.

Horticulture Division.

SINCE brown-rot decay of stone-fruit first became epidemic in New Zealand, early in the present century, methods for the control of this fungous disease have received considerable attention by the Department of Agriculture.

In 1916 the disease was the cause of considerable loss to Auckland growers, and in this *Journal* for March of that year the late Mr. A. B. Mansfield gave an outline of the life-history of the fungus and suggestions for its control, including orchard and packing-shed hygiene, and winter sprays of bluestone solution or bordeaux followed by summer sprays of lime-sulphur. In the *Journal* for August, 1917, the late Mr. G. Esam detailed the experience of Hawke's Bay growers in the control of this disease. His recommendations were along previous lines, but with further valuable additions. Orchardists in that district giving special attention to stone-fruit and applying the treatment in a thorough manner were successful in obtaining a practical control while others were experiencing heavy losses.

Since that period extensive tests (also recorded in the *Journal*) have been carried out at the Arataki Horticultural Station, and in co-operation with fruitgrowers in the Auckland and Nelson districts, with varying results. Sometimes the results have been very satisfactory; but one important conclusion arrived at, and which seems correct, is that harvest periods with warm humid atmospheric conditions are specially favourable to the disease, which is then naturally more difficult to control. As this condition often occurs in the Auckland District, further researches in the problem have been carried out there.

LAST SEASON'S EXPERIMENTS AT HENDERSON.

During the 1925–26 fruitgrowing season experiments were carried out in the orchard of Dr. R. H. Makgill, at Henderson. Dr. Makgill kindly co-operated with Mr. W. H. Rice, Orchard Instructor, Auckland, who reports as follows:—

During the winter of 1925 all peach-trees on the area were methodically pruned, special attention being given to the removal of dead or diseased wood and the removal of mummified fruits. All prunings and refuse were carefully collected and removed from the area and destroyed. The land was ploughed at bud-movement, and no further cultivation given until after the fruit had set, as past local experience had shown the bud and blossom form of brown-rot to be extensive, and it was hoped by non-cultivation to reduce the dissemination of spores.

For early sprayings the orchard was divided into two blocks, in order to give bordeaux *versus* lime-sulphur a comparison base for later sprays. These base or initial sprays were applied at bud-movement, according to variety, from 17th to 27th August, bordeaux, 5–4–50, followed by red-oil emulsion, 1-15, being applied the same day as an insecticide on one block, and lime-sulphur, 1–15, on the other block.

No oil was applied to the lime-sulphur block, lime-sulphur being considered a dual-purpose spray. The base sprays were applied under good conditions, and several days elapsed before rain fell. The blocks were divided into sections for further sprays as follows (the numbers in the table representing trees):—

Peach Varieties.	Block 1.			Block 2.			Total Trees.
	Initial Spray, Lime-sulphur, 1–15.			Initial Spray, Bordeaux, 5 4–50, followed by Oil Emulsion, 1–15.			
	Section 1.	Section 2.	Section 3.	Section 4.	Section 5.	Section 6.	
Paragon ..	30	35	19	33	42	42	201
Carmen ..	14	11	6	7	18	20	76
J. H. Hale ..	6	4	1	1	9	0	12
Golden Queen ..	4	7	4	7	9	11	42
Hay's Cling ..	4	3	3	2	3	1	16

The following table shows the later sprays applied to each section:—

Stage of Growth.	Section 1.	Section 2.	Sections 3 and 4.	Section 5.	Section 6.
Early pink ..	Lime-sulphur, 1–50	Atomic sulphur, 10 lb. in 100 gallons	Lime-sulphur, 1 gallon, plus atomic sulphur, 10 lb. per 100 gallons	Atomic sulphur, 10 lb. in 100 gallons	Lime-sulphur, 1–50.
Petal-fall ..	Lime-sulphur, 1–120	Ditto ..	Lime-sulphur, ½ gallon, plus atomic sulphur, 5 lb. per 100 gallons	Ditto ..	Lime-sulphur, 1–120.
Three weeks later	Ditto ..	Atomic sulphur, 8 lb. in 100 gallons	Lime-sulphur, ½ gallon, plus atomic sulphur, 4 lb. per 100 gallons	Atomic sulphur, 8 lb. in 100 gallons	Ditto.
Half-grown ..	,, ..	Ditto ..	Ditto	Ditto ..	,,
Prior to ripening	,, ..	,, ..	,, ...	,, ..	,,

This gave as a test lime-sulphur *v.* atomic sulphur *v.* combination lime-sulphur plus atomic sulphur, each following on the respective base or initial sprays of bordeaux and lime-sulphur.

No valuable variation of results in brown-rot control were obtained from the winter base sprays, though bordeaux was a decided advantage in the control of peach leaf-curl, and gave much better general health tone to foliage than lime-sulphur. The latter allowed leaf-curl to develop, and the foliage showed less development, with a characteristic crinkle of the edges. Spring forms of brown-rot infection noticed were bud-rot, blossom-rot, and twig-rot. These forms were remarkably consistent according to the susceptibility of the variety; the degree of infection was practically equal under each spray test, *and appears to be largely a matter of varietal resistance.* The following notes were made:—

Carmen: Bud-rot, blossom-rot, and twig-rot all bad. Loss equals 70 per cent. of crop as indicated by bud-development.

Golden Queen: Bud-rot and blossom-rot bad; twig-rot very bad. Loss of 50 per cent. of crop as indicated by bud-development. Tree of

most luxuriant habit, and so maintains a heavy supply of new wood in spite of excessive twig-rot.

J. H. Hale: Considerable bud-rot; very early infection resulted in buds falling badly. Loss of 40 per cent. of crop as indicated by bud-development. Traces only of blossom-rot and twig-rot.

Hay's Cling: Pronounced bud-rot, equal to 40 per cent. loss of crop as indicated by bud-development. Traces only of blossom-rot and twig-rot.

Paragon: Practically no bud-rot or blossom-rot; traces of twig-rot, but not sufficient to affect crop.

Though none of the sprays applied gave thorough control of spring infections of brown-rot, a far lesser infection was present than on similar varieties in orchards in the same district where consistent spring spraying was not done nor the land properly cleared of dead wood and mummified fruits.

Summer Infection (Fruit-rot or Ripe-rot).

The comparative degree of fruit-infection on the various sections and varieties is shown in the next table:—

Section.	Spray.	Variety of Peach-tree.				
		Carmen.	Paragon.	J. H. Hale.	Hay's Cling.	Golden Queen.
		Lime-sulphur Base.				
		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1	Lime-sulphur ..	50	35	20	50	30
2	Atomic sulphur ..	5	5	No crop	15	2
3	Atomic sulphur plus lime-sulphur	35	5	,,	10	5
		Bordeaux Base.				
4	Atomic sulphur plus lime-sulphur	15	5	2	6	5
5	Atomic sulphur ..	5	5	2	2	2
6	Lime-sulphur ..	35	12	10	15	5

The poor results on Section 1 (lime-sulphur on lime-sulphur) as compared with Section 6 (lime-sulphur on bordeaux) may be accounted for in large measure by Section 1 being so located under a belt of pines as to be overshadowed from the afternoon sun, while Section 6 was in an open situation and may be considered a good test of the summer value of lime-sulphur. Atomic sulphur will be noted as showing satisfactory results, though not a full control. Atomic plus lime sulphur gave reasonably good results, and, being less expensive than atomic alone, showed equal results per unit of cash expenditure. Lime-sulphur did not compare favourably with either atomic or the combined spray.

In the main the season was not one in which brown-rot was as prevalent as usual, but the benefits of summer sprays were well emphasized. On 22nd January, 1926, a heavy gale with driving rain was experienced in the district, resulting in a large proportion of all crops becoming chafed and twig-bruised, which provided a ready means of infection by brown-rot.

Unsprayed trees in an adjoining block and adjacent parts of the district had from 50 to 95 per cent. of the crop affected by brown-rot, whereas the fruits under sprays of atomic sulphur showed only 2 per cent., atomic plus lime sulphur 5 per cent., and lime-sulphur 5 per cent. to 30 per cent., of infection respectively.

Autumnal Condition of Trees under Test.

Atomic-sulphur sections: Strong growth; bright-green, luxuriant foliage, hung well into early winter; general condition all that could be desired.

Atomic-sulphur-plus-lime-sulphur sections: Good condition, though not so robust or luxuriantly foliaged as atomic sections.

Lime-sulphur sections: Good condition, but hardened growth. Foliage somewhat sparse, constricted, and generally less luxuriant than one would desire.

Summary.

Bordeaux is to be preferred to lime-sulphur as a delayed dormant spray.

Bud-rot, blossom-rot, and twig-rot are modified but not fully controlled by any of the sprays applied. Degree of infection is largely a matter of susceptibility of variety.

Atomic sulphur, 8 lb. to 100 gallons of water, gave reasonably satisfactory control of summer fruit-rot.

Atomic sulphur, 4 lb., plus lime-sulphur, ½ gallon per 100 gallons, while not so good as atomic sulphur, 8 lb. to 100 gallons, alone, shows promise of reasonable control at a lesser cost.

Lime-sulphur is not satisfactory for summer control, and lowers the health tone of the trees.

Atomic sulphur exercises a beneficial influence on the general health of the trees.

Shelter-belts should not be allowed to overshadow the orchard area.

Readers who are specially interested in this subject may be referred to the valuable research work of Mr. G. H. Cunningham, of the Department's Biological Laboratory. The life-history and habits of the brown-rot fungus were fully described by him in this *Journal* for August, 1922. The article—entitled "Brown-rot, *Sclerotinia cinerea*, Schroeter: Its Appearance, Cause, and Control"—is available in reprint form as Bulletin No. 101. Mr. Cunningham has also dealt very fully with brown-rot in his book "The Fungous Diseases of Fruit-trees in New Zealand."

Contagious Mammitis.—During the official year 1925–26 the number of samples of milk received at the Wallaceville Veterinary Laboratory for examination for contagious mammitis was 2,097, being an increase of 484 over the previous year. Of this number, 1,178, or 56·2 per cent., were found to contain the specific organism. The increase in samples is considered by the Live-stock Division to have been due to the greater amount of publicity centred on this disease during the earlier part of the year, and as a result of lectures and general advice by veterinary officers.

CORTICIUM-DISEASE OF POTATOES.

FURTHER EXPERIMENTS AND ADVICE FOR CONTROL.

G. H. CUNNINGHAM, Mycologist, and J. C. NEILL, Feild Mycologist, Biological Laboratory, Wellington.

IN the *Journal* for January and February, 1925, were published details of laboratory experiments on the control of corticium-disease of potatoes, and as a result it was recommended that a solution of acidulated mercuric chloride be used for treating the seed tubers. Subsequently a series of field experiments based on this laboratory work was undertaken at Gore Experimental Area, Southland; Moa Seed Farm, Central Otago; Ashburton Experimental Farm, Canterbury; and Central Development Farm, Weraroa, Wellington.

In these field experiments were used the solutions recommended in the *Journal:* (*a*) Overnight treatment, 1–10–10,000 (= 1 gram mercuric chloride, 10 c.c. concentrated hydrochloric acid, and 10 litres water); (*b*) five-minute treatment, 1–10–1,500. In addition the following strengths were used: (*c*) 1–15–1,500, dipped five minutes; (*d*) 1–25–1,500, dipped five minutes; (*e*) 2–20–1,000, dipped eighty minutes.

Exact data were obtained only from the Gore and Ashburton experiments, and these are presented in tabular form as follows:—

Table 1.—Total Weight of Tubers dug; Variety, Arran Chief.

Treatment.	Gore.		Ashburton.	
	Number of Sets planted.	Weight of Tubers dug.	Number of Sets planted.	Weight of Tubers dug.
		lb.		lb.
Control	220	269	200	157
Treatment *a*	440	502	150	226
Control	209	299	200	310
Treatment *b*	418	521	400	683
Control	209	208	200	313
Treatment *c*	418	399	400	580
Control	220	213	200	291
Treatment *d*	440	376	400	585
Control	220	189	200	296
Treatment *e*	440	79	..	..
Control	220	169	..	..

Table 2.—Infection of Tubers with Sclerotia of Corticium-disease, Ashburton.

Sample of 100 seed-size tubers from each lot washed and examined.

Treatment.	Number of Tubers severely infected (Large Sclerotia).	Tubers slightly infected (Minute Sclerotia and Traces).	Clean Seed.
Treatment *a*	52	47	1
Treatment *b*	25	73	2
Treatment *c*	25	72	3
Treatment *d*	18	79	3
Control (*a*)	39	62	..
Control (*d*)	33	67	..

Table 3.—Infection of Tubers with Sclerotia of Corticium-disease, Gore.

Sample of 10 lb. of tubers from each lot washed and examined.

Treatment.	Severely infected.	Slightly infected.	Clean.
Control	187	79	10
Treatment *a*	22	10	209
Control	168	62	2
Treatment *b*	115	36	88
Control	175	81	2
Treatment *c*	68	35	171
Control	209	21	15
Treatment *d*	51	13	203
Control	211	107	9
Treatment *e*	11	6	260

COMMENT AND ADVICE FOR GROWERS.

It will be seen from the data here presented that the acidulated corrosive sublimate method, though giving excellent results in the laboratory, failed to control corticium-disease in the field. At the strengths and times recommended in the previous *Journal* article the dip does not materially affect the yield, nor, as the tables show, does any damage result with solutions of a much greater concentration; but if the tubers are exposed for a much longer time to the action of the solution serious damage may result.

For these reasons potato-growers are advised not to treat their seed tubers by this method. Experiments are now in hand with other methods of combating this important disease, but until one of them proves a success under practical farm conditions we can only advise that lines showing heavy infestation of sclerotia should be rejected for seed purposes.

For assistance in carrying out this year's experiments at the several farms or experimental areas mentioned the writers are indebted to Messrs. McGillivray, Sleeman, Hadfield, McKay, McKenzie, Shepherd, and Wards respectively.

Importation of Live-stock.—Consequent on the continued prevalence of foot-and-mouth disease in Great Britain, the embargo placed on the importation of cattle, sheep, and swine from there remained in force during the official year 1925–26. Some swine for stud purposes, also sheep, were introduced from those Australian States from which the importation is permitted, and some Jersey cattle from the United States, after having been domiciled for some months in Canada, arrived and underwent the required quarantine period. A number of horses (thoroughbreds and Clydesdales) were imported from Great Britain, and as an extra precaution against the possible introduction of foot-and-mouth disease they were all subjected to a period of quarantine. The introduction of dogs from the British Isles was considerably heavier than has been the case for some years. The following is a summary of the various classes of animals that were entered into quarantine during the year: Horses, 31; cattle, 15; swine, 38; sheep, 17; dogs, 154; fowls, 6.

Registration of Dairies.—In 1925–26 4,194 dairies for the supply of milk for direct public consumption were registered and inspected by the Live-stock Division throughout the Dominion.

FARMERS' FIELD-CROP COMPETITIONS.

TARANAKI-WANGANUI DISTRICTS, SEASON 1925–26.

J. W. DEEM, Instructor in Agriculture, Wanganui.

FARMERS' field-crop competitions were carried out in twelve centres of the Taranaki-Wanganui districts during last season, against thirteen in 1924–25, Auroa failing to obtain sufficient entries to compete in the former period. Judging, by the writer, was commenced on 20th May and finished on 22nd June. The general average weight of crops was better than in 1924–25, and this may safely be attributed to better cultivation. The total number of crops judged was 254, against 263 in the preceding season. They consisted of—mangolds, 98; carrots, 57; swedes, 51; lucerne, 26; and soft turnips, 21. The lucerne and soft turnips were judged in February. As usual, exhibits of the placed crops were staged at the Hawera Winter Show.

MANGOLDS.

The season of 1925–26 was not very favourable for mangold-growing. The wet, cold spring, followed by a sharp, dry spell in November, was not good for germination. Many farmers reworked their land and made fresh sowings, with the result that a great number of crops were late and had only a short growing season. The fact that the ninety-eight crops judged averaged 59 tons 14 cwt. per acre, against an average of 56 tons 18 cwt. in the preceding year—an increase of 2 tons 16 cwt. per acre—can be attributed to better methods in cultivation and manuring.

Varieties.

Prizewinner again stands out very prominently among the varieties grown, and of the ninety-eight crops thirty-seven were of this variety, with an average weight of 62 tons 14 cwt. Twenty of the crops judged went 70 tons per acre or over, and of these fifteen were Prizewinner and one a mixture containing Prizewinner. Giant Orange Globe was also popular on account of its good showing in the previous year, and twenty-eight crops of this variety averaged 56 tons 3 cwt. per acre. Mixed varieties, chiefly Prizewinner mixed with some other variety, were the next largest entry, fourteen crops averaging 55 tons 3 cwt. per acre. Other varieties grown were Jersey Queen, five crops averaging 49 tons 8 cwt.; Long Red, four crops averaging 39 tons 14 cwt.; White Sugar, three crops averaging 59 tons 13 cwt.; Yellow Globe, three crops averaging 63 tons 9 cwt.; White Knight, two crops averaging 53 tons 5 cwt.; and Golden Tankard, one crop, 40 tons.

Twelve competitions were judged, and in these Prizewinner was placed first in seven, second in six, third in five, and fourth in five. Giant Orange Globe was placed first in two, second in two, third in three, and fourth in three. Mixed varieties were placed first in three, second in one, third in three, and fourth in three. The other minor places were filled by a number of varieties.

Championship Crops.

Particulars of the championship crops, winning the Sutton Cups in their respective districts, are as follows:—

J. B. Hine, Toko, North Taranaki: ½ acre, after mangolds. Ploughed in June, and well cultivated before and after sowing. Variety, Sutton's Prizewinner; 6 lb. seed per acre, in 21 in. drills; sown 4th November with 8 cwt. super and 10 cwt. salt per acre. Yield of crop, 111 tons 13 cwt. per acre.

C. Willis, Matapu, South Taranaki: ½ acre, after grass. Ploughed in August. Cross and Son's Giant Orange Globe seed, at rate of 5 lb. per acre, in 18 in. drills; sown middle of October with 3 cwt. mangold-manure. Yield, 87 tons.

E. Parsons, Waitotara, Wanganui: 1 acre, after lucerne. Ploughed in June, and continuously worked as required till sown on 1st November with Sutton's Prizewinner seed, at rate of 7 lb. per acre, in 25 in. drills. Manure used, 5½ cwt. super, 1½ cwt. bone, ¼ cwt. sulphate of potash. Yield, 86 tons 5 cwt.

Other good crops were—83 tons 5 cwt., grown by J. Dakers, Kaupokonui; 83 tons 1 cwt., by Evan Jones, Toko; 81 tons 12 cwt., by H. Birch; and 81 tons 8 cwt., by E. Collins, both of Maxwelltown.

Date of Sowing, Width of Drills, and Amount of Seed per Acre.

Here a considerable variation is found, but, taking a line from the best crops grown, the following practice would appear to give the best results: Seed, 5 lb. to 7 lb. per acre; drills, 21 in. to 26 in.; sowing, the last week in October or first week in November. Some of the heaviest crops were grown in 18 in. drills, but these entail so much hand labour that it is doubtful if the extra yield compensates for the trouble.

Manures.

The competitions again emphasized the fact that any good phosphatic manure supplied in fair quantities will give good results. For instance, four crops were grown with superphosphate plus kainit or salt, and these averaged 77 tons 19 cwt.; twelve crops had super and bone, with an average weight of 68 tons 6 cwt.; fourteen crops were grown with super, bone, and potash, averaging 55 tons 2 cwt.; fifty-two crops had proprietary special manures and averaged 53 tons 18 cwt.; and five crops with a complete manure averaged 48 tons 19 cwt. From these figures it would appear as though the reduction of the phosphatic manure and addition of potash does not show any marked beneficial results. The alternative use of salt or potash is also interesting. Eight crops grown with salt added to the phosphatic manure yielded 63 tons 2 cwt., while twenty-three crops that had potash added in some form yielded 56 tons 2 cwt. From this it would appear that salt will give as good results as potash, and in some cases better. When it is considered that "spent" salt can be obtained for about £3 10s. per ton it would appear to be good practice to apply some to mangold ground, or, when choosing a potash manure, to use kainit or 30 per cent. potash, which contain large quantities of salt.

Table 1, giving the results of the twenty best crops, is of interest. In working out the cost of the manures the following prices, taken as an average throughout the districts concerned, were used: Super, £6 10s. per ton; basic super, £6; half super and half bone, £9; super, bone, and potash, £10; proprietary manure, £8 10s.; kainit, £6; sulphate of potash, £18; complete manure, £11; and spent salt, £3 10s.

Table 1.—Twenty Best Mangold Crops.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Cost per Acre.	Cost per Ton of Crop.	Remarks.
	Tons cwt.		Inches.	lb.	Cwt.		£ s. d.	d.	
Prizewinner ..	111 13	4/11/25	21	6	8	8 cwt. super, plus 10 cwt. salt	4 7 0	$9\frac{1}{3}$	Second crop of mangolds after cowyard.
Orange Globe ..	87 0	26/10/25	18	5	3	Mangold-manure	1 5 6	$3\frac{1}{2}$	After grass.
Prizewinner ..	86 5	1/11/25	25	7	$7\frac{1}{4}$	$5\frac{1}{2}$ cwt. super, $1\frac{1}{2}$ cwt. bone, $\frac{1}{4}$ cwt. sulphate of potash	2 18 3	$8\frac{1}{10}$	After lucerne.
Prizewinner ..	83 5	20/10/25	21	5	4	Mangold-manure	1 14 0	$4\frac{9}{10}$	After grass.
Prizewinner ..	83 1	30/10/25	22	7	7	Mixed manure	2 19 6	$6\frac{6}{10}$	After grass.
Prizewinner ..	82 14	26/10/25	21	6	10	Mangold-manure	4 5 0	$12\frac{1}{3}$	After grass.
Prizewinner ..	81 8	20/10/25	24	6	6	Half bone, half super ..	2 14 0	8	After oats.
Prizewinner ..	78 18	25/10/25	21	8	8	Half bone, half super ..	3 12 0	$10\frac{9}{10}$	After artichokes.
Orange Globe ..	77 8	22/10/25	28	6	5	1 nitrate soda, 4 equal parts super, slag, and bone	3 10 0	$10\frac{3}{10}$	After grass.
Prizewinner ..	76 6	29/10/25	20	4	8	Bone and super	3 12 0	$11\frac{3}{10}$	After grass.
Prizewinner ..	76 4	5/11/25	26	5	10	6 cwt. kainit, 4 cwt. mangold-manure	3 10 0	11	After potatoes.
Prizewinner ..	74 1	4/11/25	28	5	4	Mangold-manure	1 14 0	$5\frac{1}{2}$	After grass.
Prizewinner ..	73 19	20/10/25	24	6	6	Bone and super	2 14 0	$8\frac{3}{4}$	After oats.
Prizewinner ..	73 8	27/10/25	24	8	4	Super and kainit	1 5 0	$4\frac{1}{10}$	After rape.
Prizewinner ..	72 15	4/11/25	25	6	7	3 cwt. kainit, 4 cwt. mangold	2 12 0	$8\frac{6}{10}$	After peas.
White Sugar ..	72 1	20/10/25	21	6	7	3 cwt. kainit, 3 cwt. super, 1 cwt. guano	2 3 6	$7\frac{1}{12}$	After carrots.
Prizewinner ..	71 15	15/11/25	18	5	5	Half super, half bone ..	2 5 0	$7\frac{1}{2}$	After mangolds.
Prizewinner ..	71 2	20/11/25	14	4	$7\frac{1}{2}$	$1\frac{1}{2}$ cwt. kainit, 6 cwt. mangold	3 0 0	$9\frac{4}{10}$	After grass.
Prizewinner and White Knight	70 1	23/10/25	21	6	5	Mangold-manure	2 2 6	$7\frac{3}{10}$	After Italian rye-grass.
Prizewinner ..	68 9	5/11/25	14	6	4	Mangold-manure	1 14 0	$5\frac{9}{10}$	After turnips.

CARROTS.

The season was a fairly good one for this class of roots, the fifty-seven crops judged averaging 44 tons 12 cwt. per acre, compared with 41 tons 19 cwt. for the preceding season. The best crop was one grown by E. Parsons, Waitotara, of the Matchless White variety, that yielded 76 tons 14 cwt. per acre and won the Cooper Cup for best crop of carrots in the Wanganui district. This was a very fine crop of excellent quality, grown on an old lucerne stand, and showed the result of careful attention and cultivation. Another fine crop was grown by C. E. Billinghurst, Maxwelltown, variety Matchless White, 66 tons 9 cwt. The best crop in Taranaki was also of the Matchless White variety, grown by A. Ward, Okaiawa, 61 tons 2 cwt. per acre.

Varieties.

Matchless White again proved to be the most popular, thirty-three of the fifty-seven crops judged being of this variety, with an average yield of 48 tons 8 cwt. per acre. Mixed varieties, chiefly Matchless White mixed with some other variety, with eight crops, averaged 35 tons 1 cwt. Guerande, with four crops averaging 51 tons 3 cwt., did very well. So popular is this carrot becoming for sheep-feeding that next year the Maxwelltown centre intends holding a special competition for the variety. Other varieties grown were Sinclair's Champion, four crops averaging 39 tons 17 cwt.; Barriball, three crops averaging 32 tons 3 cwt.; White Belgian, two crops averaging 35 tons 1 cwt.; Magnum Bonum, one crop of 46 tons 6 cwt.; Holmes Improved, one crop of 39 tons 15 cwt.; and Yellow Intermediate, one crop of 27 tons 3 cwt. per acre.

Of the eleven competitions judged Matchless White won nine, was second in eight, third in five, and fourth in four. Mixed varieties won two, were third in one, and fourth in one; the minor places being filled by a number of the other varieties.

Best Crops.

E. Parsons, Waitotara: 1 acre, after lucerne; ploughed in June; sown 1st November with 1¼ lb. of Sutton's Matchless White seed, in 25 in. drills; manure used, 3 cwt. super, 1 cwt. bone, and ¼ cwt. sulphate of potash; yield, 76 tons 4 cwt.

C. E. Billinghurst, Maxwelltown: ½ acre, after mangolds; ploughed middle of October; sown 30th October with 1 lb. Matchless White, in 24 in. drills; manure, 4 cwt. super and bone; yield, 66 tons 9 cwt.

Reardon Bros., Maxwelltown: Ploughed middle of June, out of grass; sown 26th October with 2 lb. Matchless White seed and 5 cwt. super, in 24 in. drills; yield, 65 tons 16 cwt.

Date of Sowing, Width of Drills, and Amount of Seed.

As with mangolds, there is a considerable variation, but the following would appear to be fairly safe lines to work on: Sow during the last fortnight of October or first week of November, using 1 lb. to 1¼ lb. of seed per acre. Nearly all the heavy carrot crops were grown in 24 in. and 25 in. drills.

Manures.

Here again it is very evident that a fairly heavy dressing, 4 cwt. to 5 cwt., of a good phosphatic manure will satisfy the requirements

Table 2.—Twelve Best Carrot Crops.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Cost per Acre.	Cost per Ton of Crop.	Remarks.
	Tons cwt.		Inches.	lb.	Cwt.		£ s. d.	d.	
Matchless White ..	76 4	1/11/25	25	$1\frac{1}{4}$	$4\frac{1}{4}$	3 cwt. super, 1 cwt. bone, $\frac{1}{4}$ cwt. sulphate of potash	1 15 6	$5\frac{6}{10}$	After old lucerne stand.
Matchless White ..	66 9	30/10/25	24	1	4	Half super, half bone ..	1 16 0	$6\frac{1}{2}$	After mangolds.
Matchless White ..	65 16	26/10/25	24	2	5	Super	1 12 6	6	After grass.
Matchless White ..	64 6	30/10/25	24	1	4	Half super, half bone ..	1 16 0	$6\frac{7}{10}$	After mangolds.
Matchless White ..	61 2	8/11/25	21	1	$4\frac{1}{2}$	Special carrot-manure ..	1 18 3	$7\frac{1}{2}$	After oats.
Guerande	59 19	6/11/25	14	$1\frac{1}{4}$	5	4 cwt. super, 1 cwt. bone ..	1 16 0	$7\frac{1}{5}$	After mangolds.
Matchless White ..	59 6	26/10/25	24	2	5	Super	1 12 6	$6\frac{1}{2}$	After grass.
Matchless White ..	59 6	..	18	1	4	Super and kainit	1 5 0	$5\frac{1}{10}$	After rape.
Matchless White ..	56 9	30/10/25	28	1	5	Mangold-manure	2 2 6	9	After mangolds.
Matchless White ..	55 16	23/10/25	14	1	3	Special root-manure ..	1 5 6	$5\frac{1}{2}$	After grass.
Matchless White ..	54 11	7/11/25	14	1	$2\frac{1}{2}$	Special carrot-manure ..	1 1 3	$4\frac{7}{10}$	New land.
Guerande	54 3	4/11/25	22	$1\frac{1}{2}$	4	Super and bone	1 16 0	$7\frac{9}{10}$	After grass.

Table 3.—Ten Best Swede Crops.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Cost per Acre.	Cost per Ton of Crop.	Remarks.
	Tons cwt.		Inches.	lb.	Cwt.		£ s. d.	d.	
Superlative ..	69 8	20/12/25	14	1	3	Basic super	0 18 0	$3\frac{1}{10}$	New land.
Grandmaster ..	65 10	23/11/25	7	1	3	Special root-manure ..	1 5 6	$4\frac{7}{10}$	New land.
				Oz.					
Superlative ..	60 11	17/12/25	7	9	5	Mixed manure	2 2 6	$8\frac{4}{10}$	After lea.
Magnum Bonum ..	60 1	28/11/25	14	11	3	Turnip-manure	1 5 6	$5\frac{1}{10}$	After lea.
Grandmaster and Superlative	57 17	15/12/25	7	16	3	Turnip-manure	1 5 6	$5\frac{3}{10}$	After lea.
Superlative ..	52 7	8/1/26	14	7	2	Super	0 13 0	3	New land.
Webb's Masterpiece ..	51 18	31/12/25	14	12	3	Basic super	0 18 0	$4\frac{1}{10}$	Lea.
Grandmaster ..	51 11	5/12/25	14	11	$3\frac{1}{2}$	Bone, super, and potash ..	1 15 0	$8\frac{1}{10}$	Lea.
Grandmaster ..	51 2	..	7	11	3	Turnip-manure	1 5 6	6	New land.
Grandmaster and Superlative	50 18	8/1/26	14	7	2	Super	0 13 0	$3\frac{1}{10}$	New land.

of the carrot crop. It is often stated that carrots do not require a heavy dressing of manure, but the figures from the past season's competitions do not bear this out. Four crops were grown with 2 cwt. of manure and averaged 34 tons 2 cwt. in yield, ten used 3 cwt. and averaged 43 tons 6 cwt., twenty-four used 4 cwt. and averaged 43 tons 10 cwt., and eleven used 5 cwt., averaging 53 tons 7 cwt. Whether potash should be used or not is another debatable point. In the past season ten crops were grown using a phosphatic manure plus some form of potash, and these averaged 43 tons 9 cwt., while twenty crops grown with only a phosphatic manure averaged 47 tons 9 cwt. The best type of manure to use would appear to be super and bone. Ten crops grown with this mixture averaged 49 tons 19 cwt. per acre, compared with ten crops using super only, averaging 45 tons 3 cwt.; seven crops using super, bone, and potash averaging 46 tons 7 cwt.; twenty-seven crops using proprietary manures averaging 42 tons 18 cwt.; and three crops using a complete manure averaging 37 tons 6 cwt

SWEDES.

The season was particularly favourable for the swede crop, and it was very pleasing to note the almost entire absence of dry-rot. Whether this is due to the disease running out after a cycle of years, or whether the seasonal conditions were responsible, is hard to say. However, if the same results are obtained again next year it is safe to say that the swede will in all probability come back to its former popularity in Taranaki. Fifty-one crops were weighed, with an average weight of 41 tons 6 cwt., as against twenty-six crops in the previous season, with an average weight of 39 tons 10 cwt.

Varieties.

Grandmaster proved the most popular variety, nineteen crops averaging 45 tons 5 cwt. Mixed varieties came next with seven crops averaging 37 tons 17 cwt., followed by Superlative with six crops with the fine average weight of 49 tons 15 cwt. Other varieties grown were Masterpiece, Crimson King, Magnum Bonum, Knockdon, Monarch, and Champion. Of the six competitions judged Grandmaster won three, was second in four, third in three, and fourth in five; Superlative won one, was second in one, and third in one; Masterpiece won two, and was third in one; the minor places being filled by a number of the other varieties.

Best Crops.

A. Marfell, Toko: 6 acres of virgin land; ploughed first week in November and well worked; sown 20th December with Garton's Superlative, 12 oz. of seed per acre, in 14 in. drills, with 3 cwt. basic super; yield, 69 tons 8 cwt. per acre.

James Bolger, Mangatoki: 2 acres, after grass; ploughed 8th November and well worked; sown 23rd November, in 7 in. drills, with 1 lb. Grandmaster and 3 cwt. special root-manure; yield, 65 tons 10 cwt.

Evan Jones, Toko: 10 acres; ploughed November, and sown 17th December, in 7 in. drills, with 9 oz. Garton's Superlative and 5 cwt. mixed manure; yield, 60 tons 11 cwt.

Time to Sow, Width of Drills, and Amount of Seed.

The best time to sow swede crops would appear to cover a fairly wide range if the results obtained in the competitions are to be taken as a guide. However, it would be safe to say that the first fortnight of December is the safest time. Where the grass-grub beetle is bad, however, the sowing is best delayed till about the middle of December. Nineteen crops were sown in 7 in. drills, averaging 43 tons 14 cwt. per acre, and twenty-seven crops in 14 in. drills, averaging 42 tons 16 cwt. One of the best crops seen, however, was grown in 25 in. drills and intercultivated like a mangold crop. It is just questionable if it would not pay farmers to do this and give their swede crops better attention. The amount of seed to sow should be about 12 oz. per acre, varying an ounce or so either way.

Manures.

The best average weight per acre was obtained from the use of 3 cwt. of manure; fifteen crops using this weight averaged 47 tons 8 cwt. in yield, eleven crops using 2 cwt. averaged 43 tons 14 cwt., ten using 2½ cwt. averaged 39 tons 4 cwt., three using 3½ cwt. averaged 43 tons 10 cwt., and four using 5 cwt. averaged 41 tons 18 cwt. The best return was obtained from the use of basic super, but there were only two crops using this manure, and they averaged 60 tons 13 cwt. Seven crops using super and bone averaged 44 tons 12 cwt., twenty-three using proprietary manures averaged 43 tons 6 cwt., four using super averaged 40 tons 3 cwt., and thirteen using super, bone, and potash averaged 37 tons 13 cwt. Here also it would appear that the reduction of the phosphatic manure and addition of some potash fails to show the benefit claimed for the latter fertilizer. Thirty-six crops grown without potash averaged 44 tons 3 cwt., whereas thirteen crops with potash averaged 37 tons 13 cwt.

SOFT TURNIPS.

The number of soft-turnip crops judged showed a slight increase —twenty-two, as compared with sixteen the previous year—but the average weight showed a decrease from 40 tons per acre to 36 tons, due partly to the dry spell after sowing. Club-root and soft-root were again in evidence, but not quite so bad as in previous years.

Red Paragon, Hardy and Imperial Green Globe, and Greystone were the most popular varieties. The best crop was one of Red Paragon, grown by C. Brock, Mangitoki, that yielded 45 tons 12 cwt. per acre. Most of the crops were grown with from 10 oz. to 12 oz. of seed and 2 cwt. to 3 cwt. of manure.

Nearly all the best crops were grown in 14 in. drills, using 12 oz. of seed. November or early December for sowing gave the best results.

Best Crops.

C. Brock, Mangatoki: 1 acre, after grass; ploughed middle of July; sown 30th December with 12 oz. of Red Paragon seed, in 16 in. drills; manure, 2 cwt. super, 1 cwt. bone, and ¼ cwt. sulphate of potash; yield, 45 tons 12 cwt.

J. W. Cleaver, Mangatoki: 1½ acres, after mangolds; ploughed middle of October; sown 18th November with 10 oz. Devonshire

Greystone and Red Paragon, in 14 in. drills; manure, 3 cwt. basic super per acre; yield, 45 tons 9 cwt.

A. Baker, Mangatoki: 1 acre, after grass; ploughed 24th October; sown 17th November, and resown 7th December, with 8 oz. Red Paragon, Hardy Green Globe, and Devonshire Greystone; manure, 3 cwt. basic super; yield, 45 tons 6 cwt.

Manures.

Best results were obtained from the use of 3 cwt. per acre of super or basic super, and here again the benefit, if any, derived from the use of potash is very doubtful. As the crop has a short growing-period the wisdom of using a readily available manure, such as super or basic super, will be easily seen.

LUCERNE.

The number of entries in the lucerne competition was slightly less than in previous years, due to the dry spell causing farmers to cut the crop for green feed at all stages of growth.

The best crop was entered by J. Clague, Manaia, whose very fine stand scored 49 out of a possible 50 points. This stand was sown on 7th December, 1923, in 7 in. drills, using 25 lb. of Marlborough seed per acre. It received 1 ton of lime per acre before sowing, and 1 ton in 1925. In 1924 it received 2 cwt. of slag per acre, and in 1925 2 cwt. of super per acre.

Another very fine stand was that of the Waimate West Demonstration Farm, sown on 8th December, 1920, in various drill-widths, with 15 lb. of Marlborough seed per acre; 5 cwt. of burnt lime was applied before sowing, and ½ ton of carbonate of lime was applied in 1925. Manure used was at the rate of 3 cwt per acre, and consisted of trials between slag, basic super, and Ephos phosphate. This crop scored 48½ points out of 50.

TUBERCULIN TESTING OF CATTLE.

Reporting on work at the Wallaceville Veterinary Laboratory during 1925–26 the Officer in Charge (Mr. C. S. M. Hopkirk) refers briefly to trials of various methods of testing as follows:—

"Following a report on intradermal testing of cattle, published by the Medical Research Council, advantage was taken of the presence of a number of cattle on the farm to try out tuberculin tests as far as possible with material to hand. It was found that: (1.) Intradermal testing had no advantages in accuracy over the usual subcutaneous method. (2.) That the time employed in carrying out the double test made the test impracticable in the field. (3.) The test could not be employed easily in the modern bail. (4.) The usual caudal fold test was more easily applied, and gave results just as reliable. (5.) Experience was required to read an intradermal test. (6.) Sloughing or serious leaking through the skin occurred often at the seat of inoculation. (7.) Intradermal reactions were not decisive when given too closely together as regards time. In this it was as unreliable as the subcutaneous method. The Calmette ophthalmic method was found to be quite as reliable as other methods, and also had the advantage that it would give results even after several inoculations by other methods. The experiment suggested the wisdom of using more than one test in doubtful cases of tuberculosis."

WAIMAUNGA EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1925-26.

C. S. DALGLIESH, Fields Instructor, Waimaunga, Grey County.

DAIRYING was established at the Waimaunga Farm by the transfer thereto in May, 1925, of a Jersey-Guernsey grade herd from the Moumahaki Experimental Farm. Later a purebred Jersey bull, Tolgrath Pretty Master, was purchased to head the herd. This bull's sire is Meadowvale Taskmaster and his dam Holly Oak's Pretty, several good butterfat-producing strains appearing in the pedigree. A four-cow milking plant was also installed.

The winter of 1925 being mild the herd wintered well, but a most unwelcome change took place at the latter end of August, September proving wet, stormy, and continuously cold, with two light falls of snow—an exceptional event on this coast. Weather conditions continued very much against dairying right to the end of the year, and, indeed, very little summer was experienced. Despite a plentiful supply of forage—oats and vetches, oat and pea hay, and ensilage—during September, all stock went severely back in condition, and carried the effects of this cold, rough spell more or less through the season. Rough weather was experienced in December, culminating in a very heavy flood, which did not improve conditions. Pastures were quite a month later than usual in growth, and it was not until January that anything like a good sole was obtained. May saw another stormy spell of weather, and again a heavy flood.

LIVE-STOCK RETURNS.

Twenty-one cows and nine heifers were milked through the season. No supplementary feed was supplied except during the cold, rough weather in September, and a few loads of hay at the roughest period in May last. The average return of butterfat per cow for the season was 244·73 lb. Doubtless increased feeding with supplementary forage crops during the autumn would have increased the returns, but it was desired to get an idea of what this class of land would produce under the treatment already carried out on the pasture. The herd was tested regularly each month. In addition to the milking-herd, eighteen head of dry stock were carried.

The small flock of ewes, consisting of eighty-two three-quarter-bred Romneys mated with Border Leicester rams, gave satisfactory results in wool and lambs. The ewes clipped an average of 8½ lb. of wool, which realized 12½d. per pound at Christchurch. A truck-load of seventy-five fat lambs was sent forward to Addington market at the end of March last and averaged £1 10s. 6d. per head. The flock also gave an indirect return through grazing on pastures which were not at all suitable for dairying purposes. A small flock on a moderate-sized dairy farm such as this (150 acres) is quite useful for cleaning up weeds and feed that dairy stock will not eat

CROPS.

Four acres of Garton oats and common vetches, sown at the rate of 1½ bushels oats and ¾ bushel vetches per acre; 3 acres of Garton oats and field-peas, sown at 1½ bushels oats and 2 bushels peas; and 1 acre of Garton oats and Early Minto peas, were sown for hay crops, 1½ cwt. of superphosphate being used for manurial purposes. Applications of 5 cwt., ½ ton, and 1 ton of lime were made throughout the field; it can safely be said that on this class of land a ton of lime will give a threefold return over land not so treated.

Although this land was three times flooded, the difference in the treatments with lime were plainly to be seen in the growing crops and in the subsequent stubble after harvest. The oat and field-pea crop averaged 1¾ tons of hay, the oats and vetches 2½ tons, and oats and Early Minto peas close on 2 tons per acre. Oats and peas make a much better hay crop here than do oats and vetches; the latter take too long to dry and are easily discoloured. In feeding either class of this hay to stock there is a good deal of waste, but more so with oats and vetches than oats and peas, Garton oats being inclined to grow strong on this land. Oats and vetches if manured with from 1½ cwt. to 2 cwt. of fertilizers per acre on land that has been limed are almost sure to result in a heavy crop, which takes a considerable time to cure for hay. For ensilage purposes, on the other hand, the crop is ideal.

Areas of 1¼ acres of Superlative swedes for main-crop purposes, and 1 acre for experimental manurial trials in the control of mottled heart, were grown. Although wet-weather conditions generally, combined with floods, interfered with cultivation and retarded sowing, the crops were sown between 30th December and 2nd January, and have done well, quite a large proportion of roots ranging from 10 lb. to 16 lb. in weight. At time of writing crop weights are not available.

Six to seven acres of white- and yellow-fleshed turnips were sown on the flat, but have not proved a success. So far on this farm satisfactory results have not been obtained from turnip-growing under this method, a much better crop always being obtained when sown in ridges.

Half an acre of chou moellier was sown in raised drills on 2nd January last. Super and bonedust, equal parts, at the rate of 3 cwt. per acre, was used as a manure. Half the area was given in addition 1 cwt. of sulphate of ammonia per acre, which resulted in a much better yield and gave good colour to the crop. The crop as a whole, however, was not up to expectations, the date of sowing being rather late.

PASTURES.

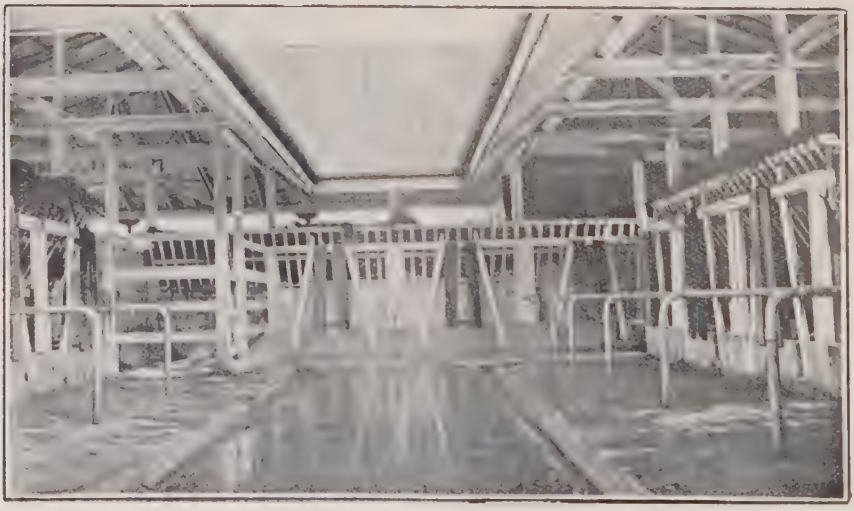
The establishment of pastures on this farm has been dealt with in previous reports in the *Journal*. Field No. 1, sown in November, 1921; Field 3, sown in April, 1922; and Field 7, sown in December, 1923, were used for the grazing of the dairy herd during the milking-period. Taking a line on the carrying-capacity of these three fields, comprising 49 acres, with pastures in reasonably good condition and heart in average years, it will take 1½ acres of pasture per cow for grazing during the milking-period on this class of land, following treatment such as has been given.

Although the pasture in Field 2 has reverted from a temporary pasture of Italian rye-grass and cow-grass, sown in the spring of 1922

to a sward of brown-top and sweet vernal, the area has proved interesting in regard to the carrying of stock. This field, together with Field 1—total, 33 acres—carried 180 dry sheep in good saleable condition from the early spring of 1924 to February, 1925. During the past season Field 2 (16 acres) carried 47 ewes and 54 lambs from lambing-time in September to the end of December. From the end of December to the 21st February these ewes and lambs, together with the remainder of

THE OPEN PIG-RUNS WITH MOVABLE HOUSES, ALSO CALF-HOUSE AND PADDOCK, AT WAIMAUNGA EXPERIMENTAL FARM.

The sheep seen are cleaning up pasture roughage.



MILKING-SHED AT WAIMAUNGA FARM.

the flock (total, 82 ewes and lambs), were grazed on Field 6, changing back occasionally to Field 2. Field 6 is old pasture land that has never been ploughed; therefore the lambs were never on young pasture until 21st February, when they were put into young pasture and rape for fattening.

Although Field 2 was kept hard stocked, the chain-width strip in the centre which had not been limed always carried a roughage of feed, and at all times presented a dry, white appearance as compared with a healthy green pasture on the limed area. Brown-top and sweet vernal are low-producing pasture plants generally, but apparently where the fertility of the soil has been raised by applications of lime and manure these grasses are quite capable of making use of the added fertility.

Field 3 suffered considerably in the early spring from the grass-grub. This field, with crested dogstail dominant, was disappointing in its production of feed, despite the fact that it had been top-dressed during the winter of 1925, and hay and ensilage fed out on it to the dairy herd.

In contrast to this result the growth and colour of the pasture of the same field in the pig and calf sections were good, though no artificial fertilizers had been applied. The pigs on this farm are kept in open runs with movable houses, and within two months from the time they were first put in a noticeable improvement in the colour of the grass was visible; likewise with the calf section. In November a half-chain strip in width was marked off in this field (No. 3), and the fresh slush and manure from the cowyard applied to it from time to time. The manure was filled every morning direct into a boxed sledge, and applied whenever the box was full. The result of this treatment was excellent, a good growth following. An interesting feature was the development of the different grasses. Although a liberal amount of cocksfoot was included in the mixture, this grass has not been prominent through the field, but is now showing up on the treated area quite markedly. The system of keeping pigs in open runs is evidently a good means of pasture-improvement on this type of land. The past season's experience convinces me that this system and the application of fresh manure from the cow-yard should be made extensive use of on the West Coast. The runs at this farm are fenced with pig netting and are made permanent. The erection of such fences so that they could be easily moved would, however, have several advantages.

The pasture in Field 7 has not been at all satisfactory. This area at time of sowing received lime in applications of 5 cwt., 10 cwt., 15 cwt., and 1 ton per acre. The heavier the application of lime the better has been the pasture, though the lighter dressings were quite right for the first year. Having been lightly stocked in 1924–25 this field was closed for haying last season, but owing to wet weather only part was cut. During the winter of 1925 the dairy cows and young stock were liberally fed on this field with hay, and, like Field 3, it had a very liberal dressing of cow-manure, which also was well scattered by tripod harrows. The results, however, were as disappointing as in Field 3. On the part of the field which had not been cut for hay but allowed to go to seed the dairy herd showed a very marked distaste for the pasture. The part cut for hay was kept closely grazed, while at the end of the season there was a good deal of roughage on the other part.

SWEDE VARIETY TRIAL IN CANTERBURY.

A. W. HUDSON, B.Ag., B.Sc., Instructor in Agriculture, Christchurch.

IN order to test the popular Superlative swede against varieties less commonly grown a trial was conducted last season on the farm of Mr. R. J. Low, Highbank (Ashburton County). The following varieties, with the exception of Nos. 1 and 2, were supplied by the New Zealand representative of D. Bell (Limited), and tried against Hurst's Superlative as a standard :—

(1.) Studsgaard Purple-top.
(2.) Wiboltts Danish Giant Purple-top.
(3.) Crimson King.
(4.) Bell's Mervue Purple-top.
(5.) Best of All.
(6.) Prima Donna.
(7.) Bell's Improved Purple-top.
(8.) Bell's Improved Bronze-top.

This series, with plots of the standard variety interspersed, was repeated eight times. The arrangement was such that no variety was separated from the standard with which it was compared by more than one intervening plot. For method of sowing and weighing plots in Canterbury experiments readers are referred to the *Journal* for July last, page 11.

Sowing was done in 14 in. drills at the rate of 12 oz. per acre. (Tests by the Department's Seed Analyst had shown all samples to have over 90 per cent. of germinable seeds.)

PORTION OF THE SWEDE VARIETY TRIAL PLOTS ON MR. LOW'S FARM.

Each plot four rows in width; only the two middle rows used for yield-determination. Poles mark standard (Superlative variety) plots. Other varieties run in order shown in list from right to left between outside poles (except middle plot). The crop tops are seen largely stripped by aphis and diamond-backed moth. [*Photo by E. M. Bates.*

A mixture of equal parts by weight of superphosphate and Ephos phosphate was sown through every coulter of the drill, so that half the manure fell in the seed rows and half between them.

The plots were weighed by Messrs. Calder, Bates, and Claridge on 24th June last, at which time the tops had almost entirely succumbed to the attacks of aphis and diamond-back moth.

The plots were inspected on 9th February last by Mr. F. E. Ward, who was of opinion that the seeding was rather heavy, but there were undoubted differences between the varieties in germination. At that time varieties Nos. 8, 4, and 7 appeared better than Superlative, No. 3 about equal, and Nos. 1, 2, 5, and 6 inferior. At the time of weighing, club-root had attacked some of the varieties, Crimson King being the worst in this respect, and Superlative the least affected.

The results of weighing are shown in the following table :—

Swede Variety Trial.

Area of individual weighed plot = $\frac{1}{773}$ acre. > = greater than.

Variety (other than Superlative).	Number of Paired Plots.	Yield per Acre.		Difference in Favour of Superlative.	Odds.
		Test Variety.	Superlative.		
		Tons.	Tons.	Tons.	
(1.) Studsgaard Purple-top	15	24·2	33·9	9·7	> 9,999
(2.) Wibolttts Danish Giant Purple-top	15	29·0	33·9	4·9	2,000
(3.) Crimson King ..	15	28·9	34·0	5·1	> 9,999
(4.) Bell's Mervue Purple-top	14	29·5	34·2	4·7	> 9,999
(5.) Best of All	14	30·3	33·8	3·5	1,300
(6.) Prima Donna ..	15	30·2	34·0	3·8	300
(7.) Bell's Improved Purple-top	16	27·0	33·5	6·5	> 9,999
(8.) Bell's Improved Bronze-top	16	30·1	33·5	3·4	171

It will be seen that the Superlative swede has proved superior to all other varieties under trial. It seems that the only way to overcome unevenness of germination is to sow thickly and thin plants to uniform distance apart.

Acknowledgments are due to Mr. Low for his keen co-operation, which enabled the work to be carried to a definite and satisfactory conclusion.

PEAR-MIDGE PARASITES.

THE Department of Agriculture has made arrangements for further supplies of *Platygaster* parasites of the pear-midge (*Perrisia pyri*) to be collected in Europe and shipped to New Zealand. The first and second consignments of these have now arrived, and are being held in cool storage until the midge becomes active. Several other consignments are also on the way.

From this material, and from that being reared in the insectary cage at Henderson from the consignments secured last year, it is expected that sufficient parasites will be on hand this season for establishing in the pear-midge-infected areas. A full account of the initiation of the work was published in the *Journal* for June last.

KING COUNTRY CO-OPERATIVE FIELD EXPERIMENTS.

WORK AT ARIA DURING 1925–26.*

J. E. F. JENKS, N.D.A., Assistant Instructor in Agriculture, Te Kuiti.

THE policy which is being pursued at the present time with regard to the Aria plots is that of grassing and top-dressing the bulk of the land. This policy is dictated partly by the difficulty of obtaining labour for cropping-work and partly by the fact that it is inadvisable to crop the typical light soil, of which the greater part of the area consists, for more than two or three seasons before giving it a spell on pasture.

Field A, which consists of flat land between the hill and the Kiokio Stream, was cleared and partially drained in the winter of 1925. Ploughing followed, but cultivation work was rendered difficult by reason of the excess of moisture. Mangolds were sown on 20th November with 3 cwt. of super and 1 cwt. of sulphate of ammonia per acre. Three strains of imported Danish varieties were tried—Wiboltts Sludstrup, Wiboltts Taarje, Wiboltts Dana—also three common varieties. Owing to the wet, indifferent tilth, germination was bad, and, though transplanting was carried out, the crop was so uneven that comparison between the different varieties was nearly impossible. In places the mangolds were excellent.

In an adjoining paddock two new Dutch varieties of soft turnip were tried. (1.) Mailand Early Flat Purple-top: This variety matures rapidly and sits well on the surface of the ground, so that it should commend itself both for carting off and grazing. The crown, however, is decidedly hollow, and it is evidently not a good keeper, so that its use will be mainly as a catch-crop. (2.) Osterundum medicum (Long Redhead) was not so quick to mature, but gave good promise.

Field B was treated in the same manner as Field A, and was sown with maize, half the area being planted in 7 in. and half in 14 in. drills. When fed out in March the cows showed a distinct preference for the slimmer stems of the 7 in. drills. Both these fields will be cropped with Japanese millet in the present season and sown with grass plots in the autumn.

Field E, a sideling partially reverted to bracken fern, was burnt over in April last and has been resown.

Field F.—The grass plots, alongside Field E, are establishing well in spite of the looseness of the soil and the invasion of bracken fern. The danthonia is making slow progress, but the paspalum is stooling out well, and the brown-top and subterranean clover are also satisfactory. Kikuyu-grass died right back during the winter, but came away again rapidly the following November, and was much relished by the stock. Planted 3 ft. apart, it is covering the ground well, and though unsuited for extensive areas (owing to the labour of planting) it should be useful for small areas of steep, light soil, even as far south as this.

* An initial article on the Aria plots, together with a sketch-plan of the experimental block showing the various fields, &c., was published in the *Journal* for March, 1925.

Field L has been sown in lucerne. A good crop of crimson clover and rye-corn (a good spring-feed mixture for this district) was turned under in October, and the lucerne-seed was sown on 21st November, together with 2½ cwt. of local inoculated soil, 3 cwt. super, and 1 cwt. of 30 per cent. potash per acre. The area sown with Marlborough seed germinated badly and was resown in March, but the Hunter River plot has grown comparatively well. The lucerne will have a hard fight to beat the sorrel and twitch, but it is hoped that by means of good manuring and cultivation the crop will be established. Generally speaking, King-country conditions are not favourable to the cultivation of lucerne.

Field M.—The grass plots in this field, sown in the autumn of 1925, have done well. They illustrate the value of early ploughing, rolling, and hand sowing, and covering with tine harrows rather than with chains. The mixtures used were as follows:—

Pasture Species.	Plot 1.	Plot 2.	Plot 3.	Plot 4.
	lb.	lb.	lb.	lb.
Italian rye-grass	6	4	4	4
Poverty Bay rye-grass	12	8	8	24
Cocksfoot (Akaroa)	8	14	14	..
Crested dogstail	..	3	..	3
Timothy	..	3	3	3
Cow-grass	4	4	4	4
White clover	1	1½	1½	1½
Lotus major	..	½	½	½
Danthonia pilosa	..	..	4	..
Total per acre	31	38	39	41
Approximate cost	£1 5s.	£1 15s.	£2 1s.	£1 8s.

The mixture sown in Plot 1 is one commonly used in the district. At the time of writing it is distinctly thinner than the others. On Plot 2 the rye-grass has been decreased and the cocksfoot increased with the addition of crested dogstail, timothy, and Lotus major. This mixture so far has proved superior. Danthonia pilosa was substituted for crested dogstail on Plot 3, and on Plot 4 the whole of the cocksfoot has been replaced by rye-grass.

Recreation-ground.—Plots on this adjoining area were top-dressed in July, 1925, under the following treatments: (1) Super, 4½ cwt., and lime, 10 cwt., per acre; (2) check; (3) super, 4½ cwt. per acre; (4) check; (5) slag, 4½ cwt. per acre.

The turf was very weak before the manure was applied, but improved greatly in the first year on all the manured plots. The cattle were constantly on these, and the herbage was grazed very close when there was apparently an abundance of feed on the rest of the field. Superphosphate, and super plus lime, both gave good results.

MANAGEMENT FOR LIGHT, UNDULATING KING-COUNTRY LANDS.

A good deal of useful information has now been gained from the Aria plots, and it is possible to lay down a policy suited to the light, open, undulating lands of the King-country with a certain degree of

confidence. First, it is evident that phosphatic manures are so essential that money is better spent on fertilizing country already grassed than on labour and seed for breaking in new areas. The actual need for lime and potash is still in doubt. Super and basic super should be the staple manures. Slag is good, but does not appear to be quite so effective. The aim should be to get as much as possible of the holding into regularly manured grass, consisting of cocksfoot, crested dogstail, and white clover, together with a certain amount of paspalum. Danthonia should also be sown as an insurance policy.

It is certainly desirable for the settler to do a limited amount of cropping for supplementary feed. For spring feed, Skinless barley, rye-corn, crimson clover, and Italian rye-grass are to be recommended; for late summer, Japanese millet and soft turnips; for autumn, soft turnips and chou moellier; for winter, chou moellier and swedes. Lucerne is hardly worth the constant labour that the wet climate involves. Mangolds may be grown on land of superior quality if sufficient labour is forthcoming. As much hay and ensilage as possible should be saved, more especially as the swede crop is becoming every year more uncertain.

PNEUMOMYCOSIS IN WHITE SWAN.

A WHITE swan which had died in one of the New Zealand inland town parks was received recently at the Wallaceville Laboratory for examination as to the cause of death. The bird had not been in good health for some time previously, and was poor and anæmic. Autopsy revealed caseous nodules throughout the lungs, and the air-sacs to be almost filled with a yellow, thick, fibrinous deposit. No bacteria were present in this material nor in the nodules of the lungs. The heart-blood was also free from pathogenic organisms. Further examination revealed plaques of mould-growth on the walls of the air-sacs which had become thickened from invasion by the mycelia. Each plaque had a diameter of from 1 cm. to 3 cm., and was white in colour round the edges, but darkened and green-tinged towards the centre. Smears from these areas showed spores of a mould, and cross-sections made from the plaques showed the typical spore arrangement of *Aspergillus fumigatus*. As this is the first case of its kind noted in New Zealand it seems worthy of being placed on record.

—*C. S. M. Hopkirk, B.V.Sc., Veterinary Laboratory, Wallaceville.*

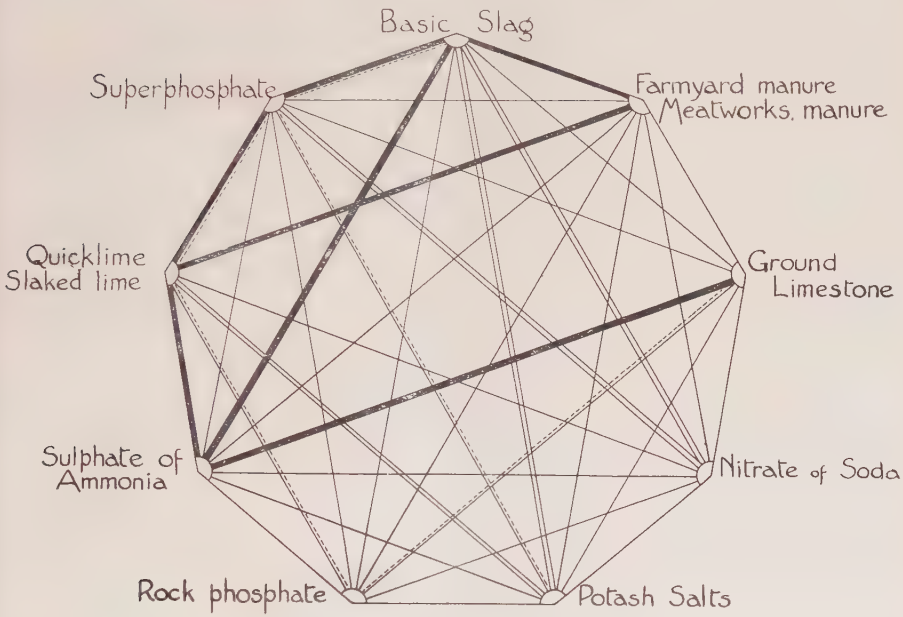
Blackberry-control Investigation.—Investigations into biological, chemical, and ecological methods of control or eradication of blackberry have been continued (states the annual report of the Fields Division for 1925–26), numerous field experiments having been laid down on the area of blackberry-infested land leased for experimental purposes in Wairoa County. Tests are also being made of top-dressing and sowing and the use of goats for the control of this weed. In Poverty Bay experiments in methods of control have been initiated on a larger scale. Here the co-operation of the owners of the land has been secured, and the practicability of employing various sprays is being demonstrated. One of these spray fluids, which is being made up according to improved methods devised in the laboratory, will no doubt prove of use for certain types of blackberry-infested land.

A FERTILIZER-MIXING CHART.

Chemistry Section.

SUBSTANCES joined by the thick line in the accompanying chart should not be mixed. Substances joined by double lines should not be mixed until just before using. Substances joined by the thin line may be mixed at any time. Where the dotted line is used to connect two fertilizers reference should be made to the following notes :—

Superphosphate and basic slag may be mixed just before sowing; if the mixture is allowed to stand it is liable to set to a hard mass.



FERTILIZER-MIXING CHART.

Superphosphate mixed with a certain amount of caustic lime is on the market under the name of basic super. About 15 per cent. of slaked lime will revert all the water-soluble phosphate in ordinary superphosphate to the dicalcic or citrate-soluble state. In case an excess of lime is present in basic super it is not advisable to mix this fertilizer with nitrogenous organic manures or sulphate of ammonia.

It is not advisable to mix superphosphate and kainit, the mixture being liable to form a sticky mass on standing. Other potash salts may be mixed safely with super.

Ground rock phosphate and lime should be applied in conjunction only after a field trial has shown that the results are better than those with rock phosphate alone.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING FACTORY AVERAGES FOR YEAR 1925–26.

Dairy Division.

FOLLOWING are lists of butter and cheese factories respectively, throughout the Dominion, that have obtained for their export produce an average grade of 92 points or over for the past dairy year, 1st August, 1925, to 31st July, 1926:—

BUTTER-FACTORIES.

Name of Company.	Registered Number.	Brand.	Average Grade.
Wairoa	1345	Wairoa	94·701
Rangitikei	1360	Rangitikei	94·699
Awahuri	664	Red Rose	94·212
Levin	910	Lake	94·114
Kia Ora	926	Kia Ora	94·012
Tolaga Bay	1007	Tolaga Bay	93·950
Cheltenham	3	Pakeha	93·910
Taieri and Peninsula (Dunedin)	54	Taieri and Peninsula	93·836
Rangiwahia	750	Quail	93·806
Waitaki (Oamaru)	812	Waitaki	93·729
Raetihi	717	Raetihi	93·723
Shannon	1489	Shannon	93·720
Rata	938	Rata	93·621
Mauriceville	14	Mauriceville	93·586
Mangorei	345	Mangorei	93·560
Kuku	805	Ohau	93·500
Tikorangi	102	Shield	93·300
North Taranaki	723	Flax	93·270
Bay of Plenty	1399	Bay of Plenty	93·262
Heretaunga	1230	Heretaunga	93·215
New Zealand (Waharoa)	293	Anchor	93·177
Taihape	1188	Tikapu	93·140
Okoia	413	Okoia	93·107
Wangaehu	1326	Wangaehu	93·096
Piopio	603	Piopio	93·089
Port Albert	298	Port Albert	93·075
Uruti	300	Uruti	93·063
Rangitaiki Plains	133	Rangitaiki Plains	93·027
Midhirst	110	Rugby	93·026
Waitara	726	Waitara	93·018
New Zealand (Frankton Junction)	1510	Anchor	93·000
Farmers' Dairy Federation	336	Murihiku	92·991
Opotiki	337	Opotiki	92·955
Tarata	631	Tarata	92·937
Akaroa	1579	Akaroa	92·931
New Zealand (Te Awamutu)	1880	Anchor	92·925
Hikurangi	303	Hikurangi	92·915
East Tamaki	301	East Tamaki	92·909
Stratford	68	Good Luck; Three Star	92·900
Maketawa	342	M.D.C.	92·899
Cambridge	1239	Cambridge	92·886
Raglan	1470	Raglan	92·828
Tarurutangi	728	Champion	92·815
Moa Farmers	341	Inglewood	92·782
Oruru-Fairburn	1337	Fairy	92·731
New Zealand (Tuakau)	1320	Anchor	92·727

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
New Zealand (Pacrata) ..	109	Anchor	92·682
Tamaki	1463	Bell	92·660
West Coast Farmers	675	Silverpine	92·609
Waipukurau	1455	Dewdrop	92·595
Maungaturoto	1407	Maungaturoto	92·595
Kaipara	794	Poplar	92·593
Whangarei	1720	Kauri	92·582
Kaitieke	1119	Kaitieke	92·574
Bell Block	488	Bell Block	92·569
Kiwi	299	K.D.C.	92·564
Murchison	1888	Airship	92·542
Bay of Islands	1312	Bay of Islands	92·539
New Zealand (Ngatea) ..	291	Anchor	92·538
New Zealand (Waitoa) ..	91	Anchor, &c.	92·498
Northern Wairoa	1358	Northern Wairoa ..	92·488
Te Aroha	344	Overseas, &c.	92·480
Okitu	1270	Okitu	92·476
Lepperton	49	Lepperton	92·441
Kaitaia	1298	Kaitaia	92·441
Eltham	31	Eltham	92·437
New Zealand (Ngaruawahia) ..	22	Anchor	92·368
Tai Tapu	175	Tai Tapu	92·353
Kairanga	1768	Longburn	92·308
Rongotea	8	Rongotea	92·292
Maungatapere	1710	Moana	92·281
New Zealand (Otorohanga) ..	185	Anchor	92·274
Arahura	1516	Arahura	92·261
Kaikoura	302	Kai	92·258
Ruawai	66	Ruawai	92·234
Aria	1734	A.D.C.	92·229
New Zealand (Waihou) ..	1458	Anchor	92·219
Mercury Bay	485	Mercury Bay	92·217
Matakana	1375	British	92·212
Ashburton	620	Ashburton	92·173
Masterton	1307	Masterton	92·167
Taieri and Peninsula (Oamaru) ..	1234	Taieri and Peninsula ..	92·099
Kokatahi	1144	Kokatahi	92·081
Staveley	1719	Staveley	92·054
Manutahi	495	Manutahi	92·053
Hawke's Bay	169	Ahuriri; Clive	92·051
Rahui (Wellington Municipal) ..	202	Rahui	92·047
Rotorua	724	Geyser	92·006

CHEESE-FACTORIES.

Name of Company.	Registered Number.	Brand.	Average Grade.
Milton	1030	Milton	94·142
Te Horo	134	Allies	93·581
Tokoroa	255	Tokoroa	93·557
Dalefield	9	Dalefield	93·536
Omimi	74	Omimi	93·505
Drummond	1823	Drummond	93·444
Mosgiel	161	Mosgiel	93·434
Pihama	627	Pihama	93·425
Pihama	1111	Pihama	93·335

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
Merton	45	Merton	93·291
Seaward Downs	702	Seaward Downs	93·256
Kuku	905	Ohau	93·197
Tuturau	132	Tuturau	93·158
Edendale	36	Edendale	93·128
Hauraki Plains	1900	Hauraki Plains	93·113
Rimu	1155	Rimu	93·094
Dannevirke	391	Dannevirke	93·070
Ashhurst	1886	Hinemoa	93·056
Staveley	1719	Staveley	93·041
Maungatua	1708	Maungatua	93·023
New Zealand (Rukuhia)	114	Anchor, &c.	92·963
Brydone	1821	Brydone	92·935
Morton Mains	1604	Morton Mains	92·923
Awarua	545	Awarua	92·922
Little Akaloa	32	Little Akaloa	92·898
Nireaha	335	Nireaha	92·893
Woodville	1892	Woodville	92·867
Island	72	Island	92·859
Alton	1890	Alton	92·815
Paretai	271	Paretai	92·798
Stirling	292	Stirling	92·798
Temuka	207	Ohape	92·798
Silverstream	62	Silverstream	92·752
Paraparaumu	167	Pram	92·743
Waiohiki	1681	Waiohiki	92·738
Whiterig	798	Whiterig	92·729
Waikouaiti	18	Waikouaiti	92·720
Woodlands	1485	Woodlands	92·712
Otautau	1610	Otautau	92·696
Parkvale	1240	Parkvale	92·696
Cambridge (Fencourt)	125	Cambridge	92·691
Mangatoki	136	Mangatoki	92·687
Ryal Bush	477	Ryal Bush	92·678
Takamatua	33	Takamatua	92·648
Browns	925	Browns	92·630
Oteramika	813	Oteramika	92·618
Tuatapere	804	Tuatapere	92·608
Bidwill	270	Bidwill	92·608
Fairfax	1004	Fairfax	92·606
Oroua Downs	94	Oroua Downs	92·606
Kai Iwi	1565	Kai Iwi	92·587
Boggy Burn	703	Boggy Burn	92·569
Pihama	1112	Pihama	92·564
Ashburton	81	Ashburton	92·547
Norfolk	1093	Norfolk	92·547
Gorge Road	567	Gorge Road	92·527
Bell Block	488	Bell Block	92·489
Lowgarth	629	Lowgarth	92·480
Maharahara	984	Maharahara	92·479
Orepuki	1744	Orepuki	92·474
Thornbury	1581	Thornbury	92·474
Tawaha	1722	Tawaha	92·470
Mataura	38	Mataura	92·436
Pembroke	234	Pembroke	92·435
Milford	267	Milford	92·429
Mokotua	67	Mokotua	92·401
Kairanga	182	Kairanga	92·362
North Tiraumea	1599	Kohinui	92·356
Cambridge (Monavale)	127	Cambridge	92·351

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered Number.	Brand.	Average Grade.
Waianiwa	1171	Waianiwa	92·344
Bainesse	808	Bainesse	92·339
Tatua	34	Tatua	92·329
Woodend	1586	Woodend	92·312
Newman	966	Newman	92·310
Wright's Bush	206	Wright's Bush	92·295
Menzies Ferry	623	Menzies Ferry	92·293
Makowhai	213	Makowhai	92·271
Kelso	1266	Kelso	92·269
Mata	258	Vale	92·250
Kiritaki	1521	Premier	92·244
Uruti	300	Uruti	92·240
Collingwood	1254	Collingwood	92·236
Manakau	815	Black Swan	92·226
Otamita	17	Otamita	92·222
Wyndham	59	Wyndham	92·219
Oware	662	Oware	92·218
Hukanui	27	Hukanui	92·210
Featherston	360	Featherston	92·197
Waimana	1817	Waimana	92·195
Takapau	75	Takapau	92·190
Rexdale	481	Rexdale	92·189
Tokomaru	972	Tokomaru	92·185
Opouriao	1169	Opouriao	92·183
Bruntwood	1534	Bruntwood	92·168
Lochiel	659	Lochiel	92·160
Manawatu	1189	Reliance	92·152
Tararua	444	Tararua	92·137
Pine Bush	543	Pine Bush	92·131
Kennington	205	Kennington	92·122
Tuna	209	Tuna	92·121
Ballance	1	Ballance	92·121
Tiakitahuna	1889	Tahuna	92·116
Henley	1627	Henley	92·094
Momona	1010	Allanton	92·094
Otahuti	231	Otahuti	92·093
New Zealand (Matamata) ..	318	Anchor, &c.	92·081
Kokotau	809	Kokotau	92·081
Collingwood	1742	Collingwood	92·075
New Zealand (Wharepoa) ..	173	Anchor, &c.	92·066
Pahiatua	140	Rival	92·055
Cambridge (Gricedale) ..	128	Cambridge	92·054
New Zealand (Eureka) ..	353	Anchor, &c.	92·052
Waihakeke	370	Waihakeke	92·050
T. L. Joll	1727	Maori Chief	92·049
Marima	195	Marima	92·047
Hamua	164	Hamua	92·034
Greytown	529	Greytown	92·027
Glen Oroua	906	Glen Oroua	92·008

Water Content of Export Butter.—During 1925–26 the system adopted by the Dairy Division of testing for moisture content one box of butter from every churning forwarded to the grading-stores was continued, a total of 127,753 churnings for export being thus tested. These showed an average water content of 15·200 per cent., which is slightly higher than the preceding year's average. No complaints were received from Britain regarding excess of water in New Zealand butter. The legal limit is 16 per cent.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT

PASTURES will be making good growth during October, especially where fertilizers have been applied during winter or early spring, consequently good management during that month will influence to a great extent the utility of the pasture throughout the summer. Judicious grazing is the best control for the pasture, but if, later, there is any tendency to coarseness or running to seed the mower should be run over the field. It is the short, sweet grass that gives the return, both for sheep and dairy cows; if a pasture is allowed to get rough, production will drop. Permanent grass intended for hay may still be closed during October, but earlier closing results in a finer-quality hay; it also provides a succulent aftermath when it is most needed, about December or January.

FORAGE CROPS.

Rape and Kales.—In favourable districts the first sowing of rape can be made during the coming month, leaving the main crop till early November. It is always wise to sow the crop in breaks at intervals, according to local conditions, to give a continuous crop of maturing rape during the fattening-period. This avoids the danger of over-ripeness, and also helps to restrict the ravages of aphis if that pest attacks the crop.

Any of the kales can be sown in October to come in from the middle of January and beginning of February. Chou moellier is well adapted for this purpose. It is less susceptible to the attacks of blights and aphis than most cruciferous crops, and is resistant to club-root. It provides fine fodder for cows in late autumn, and may be fed right through winter. It is also excellent for wintering pigs. A suitable sowing is 1½ lb. per acre, with about 3 cwt. of superphosphate.

Soft Turnips.—These are very useful for cow-feeding or lamb-fattening early in the New Year. Among the best varieties are Red Paragon, Purple Mammoth, Devonshire Greystone, and Imperial and Hardy Green Globe. For cow-feeding it is best to sow about one-third of the area in Red Paragon and the remainder in one of the Green Globes. The Red Paragons can be fed first, and by the time they are finished the Green Globes should be in good condition for feeding. A good plan on new land is to sow on the flat. Where the land has been cropped and become foul with weeds it is best to sow on ridges 21 in. to 28 in. apart, so as to allow the crop to be intercultivated and cleaned. Rate of seeding is 10 oz. to 12 oz. on the flat and 1 lb. to 1½ lb. on ridges. Basic super makes a good manure for average soils.

Mangolds.—For late winter and early spring feeding for dairy cows and breeding-ewes mangolds are hard to beat. Among good varieties are Prizewinner, Giant Orange Globe, White Knight, White Sugar, and Red Intermediate. It is good practice to grow two varieties, and stock appear to like a change. Mangolds should be sown in drills 21 in. to 28 in. apart, so as to allow plenty of intercultivation with the horse-hoe. Sow at from 5 lb. to 6 lb. per acre and manure liberally, giving from

4 cwt. to 6 cwt. of a phosphatic manure, plus 3 cwt. of kainit or 3 cwt. to 5 cwt. of salt, per acre. The salt or kainit should be broadcasted and harrowed in a week or so before the seed is sown. If sown through the drill with the seed it delays germination. It is a good plan to soak mangold-seed for twenty-four hours in water, then spread it out in a shed to dry. It may be sown the following day, but is best left for a week, as it will then be near germinating and will come through the ground very quickly. This is a great advantage where weeds are bad. The system of sowing mangolds in special beds and transplanting out the plants is becoming increasingly popular. This method allows of much extra cultivation and killing of annual weeds before the crop is transplanted. Where grass-grubs and caterpillars are troublesome this method is again an advantage, in that the larger plants are not influenced by attacks.

Carrots.—This crop is one of the safest the farmer can grow. For cows Matchless White is still in the front rank, while for sheep Guerande gives excellent results. Carrots, like mangolds, require plenty of intercultivation, and where the area is over $\frac{1}{4}$ acre they are best sown in drills 18 in. to 28 in. apart. A suitable sowing is at the rate of 1 lb. to $1\frac{1}{4}$ lb. per acre. Manure recommended for mangolds is suitable for carrots, except that the kainit or salt may be reduced to 1 cwt. per acre or omitted altogether. An idea prevails in some parts that carrots will not stand heavy manuring, but this is not borne out by experience.

POTATOES.

The main crop can be planted during the coming month. Potatoes do best on loamy soils with plenty of organic matter, and with an inclination to siltiness rather than to heaviness. A fairly fine preparatory tilth is necessary. Care should be taken that the seed is free from disease. Common scab appears as a scab about $\frac{1}{8}$ in. deep and the size of a threepenny-piece or larger. Powdery scab in the young stage looks like a small blister; later these burst and appear in small patches of pustule; each pustule is about the size of a wheat-grain, with a crater-like appearance, and has broken, flappy edges which are raised slightly over a hollow centre containing brown powdery spores. Corticium is carried over on the tuber in what appears to be small patches of dirt; these are found to be hard, but are easily scraped off, showing dark brown underneath. This is a very common disease, though often not noticed, and causes more loss than is sometimes thought. Land known to have been infected with powdery scab in the preceding season should be avoided. A very useful manure for potatoes is 6 parts super, 1 part blood-and-bone, and 1 part sulphate of potash, applied at the rate of about 4 cwt. per acre.

CEREAL CROPS.

Spring sowing of cereals for grain will now be about over. In the case of autumn- or winter-sown crops, if sheep have been grazed thereon, the ground should be harrowed when they are removed, partly to aerate the roots and partly to break the surface cake and conserve moisture. Judicious feeding-off and harrowing will not reduce the yield of a tillering variety of oats or wheat, but rather produce a denser crop. Care must be taken, however, not to feed too late in the season.

CALIFORNIAN THISTLE.

In treating patches of Californian thistle on arable land the ground should be kept cultivated until March, never letting thistles appear on the surface Cultivation requires repeating about once a fortnight. A grubber having broad overlapping tines is a suitable implement to use for this purpose.

—*Fields Division.*

THE ORCHARD.

SPRAYING.

In last month's notes the programme outlined dealt with spraying up to the "petal-fall" period, and in some instances to the period two weeks later. The completed calendar for the season is now given below. Orchardists should order sufficient supplies of the various materials in good time so that they may be on hand when the applications are required to be made.

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Stone-fruits—continued.		
San Jose scale. Red mite. Black and green aphis.	(5.) Lime-sulphur, 1 in 125, plus 6 lb. precipitated sulphur, or Black Leaf 40, 1 in 800, and soap.	(5.) At intervals as required (frequently during early summer).	Important that spray should be applied as soon as aphis appears.
Cherry-slug.	(1 and 2.) Arsenate of lead, 3 lb. paste or 1½ lb. powder to 100 gallons.	(1.) As soon as fruit is picked if slug has made its appearance. (2.) Eighteen days later, if necessary.	
Bladder-plum. Brown-rot. Leaf-curl. Leaf-rust. Die-back. Shot-hole.	(4.) Lime-sulphur, 1 in 125, plus 6 lb. precipitated sulphur, or bordeaux, 3–4–50.	(4.) At intervals as required. (For brown-rot control apply sulphur spray at intervals of from eighteen to twenty-one days until fruit is harvested.)	Gather and destroy all brown-rot-affected fruits, together with portion of spurs to which they are attached.
	Pip-fruits—continued.		
Red mite. Woolly aphis. Scales.	(5.) Lime-sulphur, 1 in 100, plus 6 lb. precipitated sulphur, or Black Leaf 40, 1 in 800, and soap.	(5.) At intervals as required.	

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
		Pip-fruits—continued.	
Apple leaf-hopper.	(3.) Lime-sulphur, 1 in 100, plus 6 lb. precipitated sulphur, or Black Leaf 40, 1 in 800, and soap.	(3.) At intervals when nymph stage is present on trees.	Infection in March is frequently a heavy one, and it is necessary to make at least two sprayings—one within fourteen days of the other—to obtain best results.
Codlin-moth.	(1, 2, and 3.) Arsenate of lead, 3 lb. paste or 1½ lb. powder per 100 gallons, plus milk of lime when intended to be combined with a lime-sulphur spray.	(1.) Petal-fall. (2.) At intervals of from eighteen to twenty-one days up till middle of January. (3.) Continue where necessary in respective localities until all danger of infection is past.	Keep fruit and foliage thoroughly covered with arsenate. Destroy all grub-infected fruit immediately.
Leaf-roller.	(1.) Arsenate of lead, 3 lb. paste or 1½ lb. powder form to 100 gallons. (2.) Arsenate of lead, 4 lb. paste or 2 lb. powder form to 100 gallons.	(1.) Apply at same periods as recommended for codlin-moth control. (2.) Second week in February. (3.) Spray late-maturing varieties again eighteen to twenty-one days later. (4.) Continue where necessary in respective localities until all danger of infection is past.	Add milk of lime to arsenate of lead when it is intended to combine it with a lime-sulphur spray.
Pear-slug ..	Sprayings applied to control codlin-moth are usually sufficient.		
Powdery mildew.	(5.) Precipitated sulphur, 10 lb. to 12 lb. per 100 gallons.	(5.) At intervals of three weeks during early summer months. (6.) Later in season when necessary.	Good results are also obtained from application of lime-sulphur, ¾ gallon to 100 gallons water, plus 8 lb. to 10 lb. precipitated sulphur.

SPRAYING CALENDAR—*continued.*

Pest or Disease.	Spray to use.	Time of Application.	Remarks.
	Pip-fruits—continued.		
Black-spot of apple.	(5.) Lime-sulphur, 1 in 100, plus 8 lb. to 10 lb. precipitated sulphur.	(5.) At intervals as required. In areas where black-spot is prevalent these summer sprays are usually applied at intervals of three weeks.	Sharp lookout should be kept for late spot infection beginning about second week in March. Immediately it is observed control spray should be applied.
	Bordeaux, 3–4–50, in localities where black-spot very troublesome, on varieties most susceptible to this disease.		
Black-spot of pear.	(5.) Bordeaux mixture, 3–4–50	(5.) At intervals as required. In localities where disease is prevalent apply every three weeks.	Advisable to apply lime-sulphur, 1 in 100, to Winter Cole, P. Barry, and Josephine varieties in place of bordeaux.

CULTIVATION AND FERTILIZERS.

In all localities where soil conditions permit cultivation should receive special attention, and every effort should be made to reduce the soil to as fine a tilth as possible. There are but few orchards where cultivation can be dispensed with. An important point which must not be lost sight of is that the season's crop largely depends on the condition in which the soil and the trees are kept during the early summer months.

It is not too late to apply nitrogenous and phosphatic fertilizers, but the application should not be further delayed.

GRAFTING AND BUDDING.

Grafting may still be done, but it is important to remember that to obtain the best results the scions used should be kept dormant.

All stocks successfully worked last season by grafting or budding should be kept well disbudded, and water shoots and suckers should be removed. If stocks on which buds were inserted have not been cut back this should be done at once to encourage a straight trunk.

FRUIT IN STORAGE.

Stored fruit should now be examined once a week. Growers are advised to dispose of their fruit while it is in prime condition and before it shows any sign of shrivelling. In the past much loss has been occasioned because of neglect in this direction. Fruit in poor condition cannot realize good prices, it is hard to sell, and it is unsatisfactory to the consumer.

—*W. K. Dallas, Orchard Instructor, Dunedin.*

CITRUS-CULTURE.

Pruning: When danger from frost is over, the tops of trees which have been damaged may be cut back to good, sound growth. At this time it is usual to find ends of leaders and laterals which have been injured not only by frost but also by brown-rot and excessive wind. All this damaged wood should be removed.

Cultivation: Spring cultivation to a good depth will assist towards forcing the rootlets to a greater depth and ensure a more equitable moisture during summer. Where the land is in rough weeds or cover-crop the plough should be used and the land worked to a fine tilth immediately after. Where the land is reasonably clear and has been winter-ploughed no time should be lost in breaking up the ground to a depth of several inches with a good cultivator.

Spraying: For control of scale and sucking insects oil emulsion, 1-40, should be applied. Bordeaux, 4–4–40, should be applied just prior to the oil where citrus brown-rot has been bad or the trees attacked by other fungi. Further applications of bordeaux at the same formula will be required as the petals fall from the spring blossom, and at intervals later to ensure that all young fruits are covered with spray against verrucosis and grey scab.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

THE YOUNG STOCK.

If all the chickens required this season have not yet been hatched no time should be lost in getting every possible egg put into the incubator or placed under broody hens. There are only a few weeks more for the production of stock which will meet with those favourable conditions necessary to their best development. The drawbacks to late hatching are many, the chief among which being that the chickens have the midsummer heat to contend against, and are then subjected to the cold weather often experienced in the early autumn before they are properly developed.

Poultry-keepers who have to depend on the natural means of incubation and have been handicapped in securing the number of chickens they desire owing to inability to secure broody hens may counteract the drawbacks of late hatching to a certain degree (now that broody hens are more plentiful) by judicious management. The chickens should in every way be encouraged to develop without check. They should be well protected from wind and hot sun. The coop should be frequently moved to fresh ground. Only good, wholesome, grain food should be supplied. Green food is of special importance, and should be fed in abundance. Finely cut succulent grass, lucerne, clover, watercress, lettuce, silver-beet leaves, or even young cabbage-leaves, provide excellent green material for growing chickens. A constant supply of charcoal, grit, and clean water should be kept before the young birds.

There is nothing better for chickens or, indeed, fowls of any age than fresh skim-milk. Where this is available it may be given in good quantities. Care must be taken where milk is provided that the drinking-vessels are kept in a clean, sweet state. It is a mistake to supply sweet milk one day and sour the next, as this is apt to bring on bowel trouble; it should be always sweet or always sour. Personally, the writer prefers it to be sweet at all times where very young chickens are concerned.

If any one requirement should be emphasized more than another it is that of cleanliness and preventing the chickens becoming infested with parasitic life. This implies the frequent removal of droppings and the spraying of the quarters with a reliable disinfectant. It is also important that the mother hen and her brood have access to a good dusting-place in order to free themselves of insect pests.

CHICKEN-COOPS.

A great weakness on many plants is the makeshift appliances which do duty for chicken-coops. This is not to infer that elaborate or expensive coops are necessary. There are few men on the land who cannot make a good-enough coop. Where the worst mistake is made is in failing to construct the coop solidly enough, and in not making it sufficiently draught and rain proof. A box with a sack thrown over it and a few bricks placed on top to keep the sack in place may do well enough in ideal weather, but such a contrivance is only inviting trouble and disappointment when unfavourable weather conditions prevail. Again, much loss is incurred by coops not being cat and rat proof. The makeshift coop generally proves a dear thing in the long-run.

Not only should the coop afford a proper protection for the hen and her brood, but it should also be arranged in such a way that plenty of fresh air is available at all times. It is a common thing for hens with chickens to refuse to go into the coops provided, even when cold, wet weather prevails, unless they are forced to do so. The obvious reason is that the hen knows what is best for her chicks, and rather than take them into an ill-ventilated coop, which is too often infested with red mite, she prefers to remain in the open run notwithstanding the discomfort which she has to endure. The coop should also have a run attached which will effectively protect the young birds during the day from cats and vermin. Losses in chickens from almost any cause are usually put down to bad luck, but in the great majority of cases they are due to bad management.

On no account should chickens be overcrowded. A common mistake made is to dump the chicks hatched from two or more hens with one mother. This is all right in its way when poor hatches are obtained and the number is not excessive, but to put twenty or more chickens with one mother is not sound practice. It is true that the hen may rear the majority of them, or even all, but it cannot be expected that they will make such sound development as if the number had been reduced. It is more profitable to rear a few chickens properly than many indifferently.

SPECIFIC FACTORS AND INQUIRIES.

In the management of poultry of all ages specific factors or local conditions connected with the stock and plant should always be fully taken into account. No rule relating to any branch of the business is capable of universal application. What may prove effective under one set of conditions may fail under another. For example, it is common for the writer to receive requests for advice relative to mortality among brooder chicks, but seldom do the correspondents intimate in any way the particular class or make of brooder that is being used. In such circumstances it is almost impossible to even suggest the cause of the trouble or how preventive methods may be employed.

Colony brooders are a case in point. These are made in various styles, while some are heated with coke and others with oil. In the case of the coke-burners any dampness under the hover (in reason, of course), such as might be expected to come from a concrete or moist earth floor, will in most cases prove beneficial to the chicks. In fact, some breeders who use coke-burning stoves make a practice of spraying water on the earth surrounding the brooder in order to maintain it in a more or less humid state, and with beneficial results. On the other hand, especially with some of the oil-lamp colony brooders on the market, the slightest degree of dampness may cause great losses. It will thus be seen that when lamp brooders are being used dampness surrounding the hover must be avoided at all costs. Even where the brooders are placed on a concrete floor steps should be taken to prevent dampness, or trouble is almost sure to follow. Covering the floor surrounding the brooder with a double thickness of Ruberoid or similar material will often have the desired effect.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

SWARMING.

LEADING authorities are mostly agreed that the instinct for natural increase is the cause of swarming. Many beekeepers attribute swarming to overcrowded brood-chambers, lack of ventilation, and poor queens; but it often happens that swarms issue when none of these conditions is present. On the other hand, bees will refuse to swarm when everything is apparently conducive to their doing so. It must be left to the beekeeper to decide whether he will increase his stock by natural swarming or artificially. If the former plan is adopted it will be wise to allow only strong colonies to swarm. If a weak hive is showing symptoms of swarming—that is, if the bees are building numbers of queen-cells these should be removed and the colony prevented from swarming until such time as it can be requeened. A swarm from a weak hive is not worth encouraging, because it consists simply of a poor queen, probably failing, and a small cluster of bees.

If, however, a strong colony has made up its mind to swarm, the best thing to do is to allow it to throw a prime swarm, and then to most rigorously guard against after-swarming. This can best be done by cutting out all the queen-cells save one after the prime swarm has

issued. Even then it is wise to carefully watch the parent hive for about ten days after the departure of the prime swarm, because there will be eggs in the old hive, and the bees may continue to raise queen-cells.

HIVING SWARMS.

When a swarm issues, if headed by a laying-queen, it will, after circling in the air for a short time, settle probably on some tree or shrub. As soon as the swarm has settled into a cluster, shake all the bees into a box. Place the box on its side, and cover with a clean sack, leaving a small opening for the bees to fly in and out. The swarm may be left alone until late in the afternoon. If by that time it has formed a compact cluster in the box the beekeeper will know that all is well and that it contains a queen. Have the hive in readiness, placed in position where it is to remain. Place a clean sack in front of the entrance, having propped up the front to allow the bees a good space to enter the hive. Dump the bees on the bag as close to the entrance as possible, and very soon they will make their way into the hive. The bag can then be removed and the hive be lowered into position.

In districts where foul-brood is present, or if the beekeeper is suspicious of his own colonies, it is wise to leave the swarm in the box for at least three or four days. At the end of this period place the bees in the hive as described, always choosing the late afternoon for settling them in their permanent home. The object of this practice is to induce the bees to utilize the honey in their sacs to draw down comb, and thus rid themselves of honey from the parent hive; if it is followed there will be far less trouble from disease, and swarms will invariably start clean.

Unless there is a good honey-flow, or if bad weather sets in, the swarms should be fed inside the hive. This is to give them a good start and to provide them with material for producing wax. Excellent combs can be produced from sugar-syrup. It is advisable in all cases to hive the swarm on full sheets of foundation, and thus take advantage of the natural instinct of the bees to produce wax after swarming. Very little time will be gained if the bees are put on drawn-out combs. In the course of a few days it is advisable to examine the frames to note if the queen is laying and to see if the foundation is being drawn out. When the swarm is placed in the hive one should not forget to put a mat on top of the frames. It often happens that unless precaution is taken to confine the bees they will commence operations in the roof of the hive, more particularly if gable roofs are used.

PREVENTION OF SWARMING.

Frequent examinations of the colonies—every week or ten days during the swarming season—for the purpose of cutting out queen-cells is a help; but this requires considerable work, and, since it frequently fails in spite of every care, it is not usually relied on.

The occurrence of swarming is largely due to overcrowded brood-chambers; hence the queen should be given plenty of room to lay. A suitable plan is to give a new brood-chamber comprising two drawn combs and the rest frames of foundation. Secure the queen and confine her in this new chamber below a queen-excluder, placing the old brood-nests directly above, thus giving additional work for the

young bees and plenty of room for the queen to lay in. If for some reason this plan is not desirable the brood may be equalized by robbing the stronger colonies for the benefit of the weaker.

A young queen in the hive is an outstanding factor of success, as bees are rarely inclined to swarm with a young queen if they have reared her themselves under natural conditions. This feature, however, is not always satisfactory to the beekeeper, as he frequently buys young queens in large numbers from a queen-breeder. He still has to contend against the swarming impulse, although in a lesser degree. A beekeeper rearing his own stock should select not only prolific queens to produce from, but those that have previously shown the least tendency to swarm. There are also other reasons why young queens should be employed, and the practice of introducing them in the spring before the swarming season commences, at intervals of not longer than two years, is a very excellent one. Autumn introduction is also commendable, as the full tide of a queen's maturity is gained from the commencement of the following spring. In order to follow the lives of the mothers as closely as possible and to avoid mistakes some system of recording the various ages must be employed. In addition, notes should be taken of their general behaviour, such as tendency to swarm, prolificness, and gentleness. Such notes will prove of great value in selecting a mother of future queens.

Ventilation also plays an important part in controlling the natural inclination to swarm, and care should be taken to provide sufficient air at all times of the season. A well-known and effective method is to place blocks 1 in. in height under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest. This forms two additional entrances and permits the workers to escape to the field without having to traverse the whole depth of the hive.

No single system will be found universally effective. Climatic conditions also frequently play an important part in the behaviour of bees. It will, however, be found that the methods here given, or variations of the same, employed either singly or in combination, will materially assist in the prevention of swarming.

PREVENTION OF AFTER-SWARMING.

In many cases a prime or first swarm is desirable, and in others they often issue in spite of all precautions. It is a simple matter to hive the swarm, but to combat the results in the parent colony arising from this condition entails special action. Persistent after-swarming is one of the discouraging features of natural increase, and is often hard to stop. A good plan is to place the swarm on the old location, removing the parent colony to a new stand some distance away. The immediate result is for all the flying bees to join the swarm, and thus the parent colony is still further weakened. This encourages them to tear down all queen-cells but one, or to destroy all embryo queens after the first young queen has emerged from her cell.

TREATMENT OF SWARMS: PROVISION OF SUPERS.

There is little doubt in the minds of many of the beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame

hives and not provided with room for surplus. Unless supers are given to strong, early swarms from ten to fifteen days after they are established these colonies will often swarm again, and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey. When a swarm has been established a few days a hurried examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

TOBACCO-GROWING.

"An undertaking that is well commenced is more than half done" is a proverb with special application to the tobacco crop, for the grower who has plants good and early has accomplished the more difficult part of the work of growing a successful crop. However, many dangers lie before the satisfactory accomplishment of his purpose. The seed-beds should be aired gradually in the early parts of the day, in dull, warm weather at first, thus gradually hardening up the plants. While they should by no means be allowed to dry out, it is desirable to keep them rather on the dry side now while the hardening process is taking place. Exposing them to bright sunshine while they are soft and wet will readily burn them; hence the need of carrying out this hardening process with care. If the plants are large enough this operation may be completed towards the end of October, so that they will be ready for planting out in the field as soon as the danger of hard frost is over and the soil is in condition. Keep a sharp lookout for any insect pests or disease among the seedlings and deal with them promptly. Beds of plants that are backward should be kept warm, the hardening process being delayed until they are nearly of a size for planting out.

Meanwhile the preparation of the land in which the crop is to be grown should be completed by light hoeings to destroy seedling weeds and obtain a fine even surface. Avoid deep cultivation at this period, as a firm bed into which the seedlings may be planted will give better results. Some little time before this preparation of the land is completed, broadcast such manures as may be necessary and harrow them in This application demands careful consideration. In the case of new ground little or nothing may be required; in the case of light land a moderate dressing of superphosphate only will probably meet the requirements. Remember that the kind of leaf required is one of medium size, good quality, and firm texture—not a gross leaf of a soft, sappy nature. On most soils superphosphate and sulphate of potash in reasonable quantities will secure the desired result.

On the day before lifting the plants water the seed-beds well, and, when required, lift the plants carefully with as much of the roots as possible, and place them in trays compactly in an upright position.

The trays may be covered or stood in a shady place until required. In preparation mark off the field in lines 3 ft. apart, and while an assistant places the plants 3 ft. apart along these lines follow him up with a trowel and plant each one firmly and rather on the deep side. In dry weather this operation may require to be completed by watering-in the plants afterwards. While these distances are commonly used, there is a tendency to increase the spacing between the rows and shorten it between the plants in the rows, thus allowing for the more convenient performance of topping and suckering, &c., when the plants are full-grown and the leaves are in danger of being damaged. Avoid planting on bright, hot mornings; in such weather confine this operation to the latter portion of the day. If the plants are of even size and well selected there will be very few misses; but after a day or two likely failures may be readily detected, and these should be replaced at once.

THE VEGETABLE-GARDEN.

By the time potato and seedling crops are through the ground a thick crop of seedling weeds have usually made their appearance. They are not very obvious at first, perhaps, as compared with the larger growth of the crop. To put the hoes lightly through the rows on the first fine day when the land is dry is an effective and easy way of counteracting what may easily become a costly operation and a serious menace to the success of the crop.

As the warmer weather arrives the more tender crops may be sown Where the winter and spring cabbage and broccolis have been harvested, clean up the ground and prepare it for sowing marrows, pumpkins, cucumbers, and melons, also French and runner beans. As soon as danger of late frosts is past, plant out tomatoes, egg-plants, chili peppers, and kumaras; but do not be tempted to do this when the ground is wet, even although the day be bright.

In dry, hot localities where summer cabbage is difficult to grow silver-beet may now be sown. In a piece of good ground that has been well prepared and allowed time to settle set out the cauliflower-plants from beds sown a few weeks ago. The main-crop cabbages and cauliflowers that are now established will probably benefit from a dressing of nitrate of soda when the weather is warm. Gardeners should study closely this practice of feeding growing crops with fertilizers; the adage "Feed the crop and not the land" is a horticultural epigram of the greatest importance.

In a somewhat cool situation sow beds of late celery, Brussels sprouts, and early broccoli for setting out towards the end of the year. At the same time give consideration to the question of allotting them a piece of suitable ground so that it may be in the right condition when available. These crops often follow those of early peas and potatoes.

Asparagus crops will be greatly improved by the occasional application of fertilizers. Destroy thin, useless stalks as soon as they appear.

TOMATOES AND CUCUMBERS UNDER GLASS.

Under glass the tomato crop will be well up the supporting strings and out in blossom. As under these conditions the plants are deprived of the action of winds which shake them and assist in the distribution of pollen, it is customary to assist pollination by the

artificial means of shaking the vines by hand. This is best done about the middle of the day in bright, fine weather. Suppressing lateral growths and training the plants up the strings is the most important work here. This is best done in the early morning with the top ventilators well open. Keep a sharp lookout for any disease or pests that may be about, especially black-stripe. Leave affected plants after marking them, and treat them after the rest of the plants have been attended to, carefully avoiding accidental reinoculation. In warm weather ventilate freely early in the day, but avoid chilling the plants on cold days.

The young growth on cucumbers growing under glass will now require stopping and training. Top-dress the soil with a rich compost from time to time to keep the roots near the surface, and give liquid manure frequently when the plants are cropping.

SMALL-FRUITS.

Gooseberries and currants will benefit from a moderate dressing of nitrate of soda when the fruit has set, while raspberry plantations will derive great benefit from a rather more generous application of the same fertilizer now. Plant out Cape gooseberries in rows 6 ft. apart, running north and south, with 3 ft. between the plants. Warm, light soil in a sheltered position best suits these plants. Hoe strawberry-beds for fruiting to keep them clear of weeds and prevent runners rooting, and have on hand sufficient straw for bedding down the plants as soon as flowering commences. Where this is omitted berries become soiled and gritty during rain-showers, and are thus seriously depreciated.

WEED-DESTRUCTION.

The work of weeding yards and roadways can be reduced to a minimum by the use of the arsenic weed-killer. We are indebted to Mr. A. A. Ramsay for an improvement in this recipe, which is as follows :—

Place 1 lb. arsenic and $\frac{1}{4}$ lb. caustic soda in a benzine-tin, and mix them well in a dry state. Add water gradually, and mix until the arsenic is dissolved ; then dilute with water up to twenty or even forty gallons, according to the weeds that have to be dealt with. This is best applied in settled weather so as to avoid overdilution by rains following soon after application.

Grass lawns, that should now be looking well, are sometimes disfigured with troublesome weeds. A dressing of sulphate of ammonia (1–2 oz. to the square yard) applied now during dry, settled weather will usually improve the condition of the lawn very considerably.

—*W. C. Hyde, Horticulturist*

Collar-rot of Peas.—Work on the control of collar-rot of peas has been continued at the Biological Laboratory during the past year, and from a laboratory standpoint more or less completed. In the spring of 1925 pea-seed was treated with hot water for field trials, but, unfortunately, weather conditions in Marlborough did not permit the sowing of the seed. Other treatments, including dry dusting of the seed with disinfectants, have been tested on a small experimental scale, and although none of the treatments will control the disease, some increase the vigour of the seedlings probably sufficiently to maintain a healthy plant during the early stages of the disease.

VETERINARY EXHIBIT OF DEPARTMENT OF AGRICULTURE AT NEW ZEALAND AND SOUTH SEAS EXHIBITION, DUNEDIN, 1925–26.

[Photo by H. Drake.

WEATHER RECORDS: AUGUST, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

AUGUST, regarded as the last month of winter in New Zealand, was on the whole dull and showery. Reports vary as to temperature and its effects, but the days were generally mild, though frosts occurred frequently at night in many parts of the country.

Rainfall was above the average over the greater part of the North Island and in Otago, but below the mean of former years in the Hawke's Bay and Poverty Bay districts, and in the central part of the South Island on both the east and west coasts, which is rather an unusual occurrence.

An intense westerly disturbance passed in the South on the 5th and 6th, accounting for gales, particularly in the North Island. The most general rainfall, with snow on the higher levels, was reported at this time. Three cyclones passed northward of New Zealand on the 10th, 17th, and 24th, accounting for some heavy downpours in the northern districts. A westerly disturbance at the close of the month brought welcome rains to the Wairarapa and Marlborough districts, and, in spite of frequent showers previously experienced, ended what was regarded as a dry spell.

There was a fair amount of wind, with a prevalence of south-easterlies in the North Island, but conditions were calmer farther south.

RAINFALL FOR AUGUST, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	7·10	17	1·50	5·10
Russell	8·93	17	2·37	6·99
Whangarei	11·67	20	3·65	6·93
Auckland	6·68	27	1·45	4·19
Hamilton	6·72	24	1·80	4·15
Kawhia	6·46	21	0·96	4·60
New Plymouth	7·21	21	1·50	5·29
Riversdale, Inglewood	11·41	24	1·61	8·65
Whangamomona	9·17	16	2·40	5·80
Tairua	9·66	17	2·74	6·98
Tauranga	5·84	19	1·12	4·08
Maraehako Station, Opotiki ..	7·18	15	2·34	4·75
Gisborne	3·98	18	1·22	4·55
Taupo	4·01	10	1·00	4·23
Napier	3·04	14	0·77	3·57
Maraekakaho Station, Hastings ..	2·71	17	0·70	3·31
Taihape	4·20	22	0·94	2·73
Masterton	5·39	23	2·21	3·33
Patea	3·51	18	0·54	3·57
Wanganui	2·39	9	0·38	2·78
Foxton	3·59	18	0·66	3·04
Wellington	2·96	21	0·86	4·45
South Island.				
Westport	4·69	19	0·79	6·27
Greymouth	4·90	14	1·00	7·87
Hokitika	6·35	14	1·76	9·34
Ross	10·44	12	3·78	10·40
Arthur's Pass	13·38	6	3·60	13·13
Okuru, Westland	9·00	15	2·92	11·46

RAINFALL FOR AUGUST, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Collingwood	7·50	16	1·21	6·96
Nelson	2·83	12	1·36	3·02
Spring Creek, Blenheim	3·07	14	1·30	2·86
Tophouse	5·36	14	0·85	4·87
Hanmer Springs	1·74	13	0·25	2·56
Highfield, Waiau	1·51	11	0·28	2·28
Gore Bay	1·73	9	0·46	2·28
Christchurch	1·16	15	0·35	1·83
Timaru	0·98	8	0·26	1·41
Lambrook Station, Fairlie ..	0·46	5	0·22	1·53
Benmore Station, Clearburn ..	1·92	7	0·60	1·50
Oamaru	1·98	9	0·71	1·71
Queenstown	2·04	7	0·88	1·80
Clyde	0·76	8	0·30	0·80
Dunedin	2·99	17	1·28	3·14
Wendon	2·60	11	0·55	2·08
Gore	2·94	19	0·59	2·34
Invercargill	5·42	24	0·84	3·31
Puysegur Point	..	..	..	7·20

—*D. C. Bates, Director.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 15th July to 26th August, include the following of agricultural interest:—

No. 53526, &c.: Manure and lime distributor; E. C. Houchen, Hamilton. No. 53902: Milking-machine teat-cup claw; Mrs M. B. Judd, Wellington. No. 54582: Milking-machine teat-cup; W. R. Cockburn, Auckland. No. 54667: Fertilizer broadcast sower; C. H. Gower, Marton. No. 55709: Sheep-shear comb; F. G. Bristow, Sydney, N.S.W. No. 55890: Agricultural implement (clod-crushing roller and seed-sower); R. B. Morrow, Brunswick, Vic. No. 56620: Plough; O. E. Nelson, Fernside. No. 56631: Milk cooler and aerator; F. C. Peace, Hamilton. No. 56641: Grain-drying machine; J. A. Hall, Bedford, and W. F. C. George, Northampton, England. No. 53759: Sprayer; E. G. Gresham, Auckland. No. 55045: Motor-tractor attachment: R. G. Macdonald, Bankside. No. 55974: Bee-smoker; E. W. Neumann and J. H. M. Williams, Westport. No. 56432: Harrow; E. Walders, Hamilton. No. 53641: Milking-machine; S. H. Knapp, Greytown. No. 55913: Separator, electrically driven; H. O. Corlett, Te Mawhai. No. 56796: Cheese-treating process; Lakeside Cheese Co., Plymouth, Wis., U.S.A. No. 56810: Flax-washing means; S. H. Maddren, Christchurch.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

Actinomycosis.—The number of condemnations for this stock disease throughout the Dominion in 1925–26 was 754, a decrease of 97 on the previous year. Treatment for this disease when detected in the early stages is still the policy of the Live-stock Division in lieu of slaughter, and as a result numerous cases have recovered.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RINGWORM IN CALVES.

A. ROBERTSON, Tinui :—

Please inform me what is the cause of ringworm on calves, and a remedy for the same.

The Live-stock Division :—

Ringworm is due to a species of fungus growing on the skin, and the following treatment will be found effective in curing it: Wash the affected parts with a solution of washing-soda, and after thoroughly cleansing and scraping apply tincture of iodine over the whole patch. The treatment should be repeated twice further at intervals of five days.

GROWING COCKSFOOT FOR SEED.

A. D., Arundel, South Canterbury :—

We have prepared about 8 acres of land with the intention of putting same down in cocksfoot and keeping it entirely for seed, and should be obliged if you would give us some advice in this connection. As cocksfoot is a slow grower, would you recommend sowing, say, a few pounds of rye-grass with it and grazing it with sheep for the first year?

The Fields Division :—

We would suggest that you sow either in 21 in. or 14 in. drills, using from 10 lb. to 14 lb. of seed per acre, provided you are prepared to intercultivate the crop every winter. Should you consider intercultivation impracticable, sow in 7 in. drills rather than broadcast, and use up to 20 lb. seed, the latter figure being a heavy sowing. The crop being required primarily for seed purposes, we would strongly recommend drills wide enough to allow of intercultivation, and would advise sowing without the addition of any other grass or clover. If sown this spring you should take the first cut of seed in December of next year—that is, fourteen to fifteen months after. The yield of seed and length of life of the stand will depend upon two main factors under your control: (1) Maintaining the fertility by top-dressing, by allowing a certain amount of leafage to decay on the ground, and by intercultivation to keep down weeds and conserve moisture; (2) no stocking, or the very lightest stocking, to avoid the cocksfoot becoming bared to the ground at any time.

PEANUT-GROWING.

J. L. T., Otaki :—

Will you kindly give me instructions for the cultivation of peanuts?

The Horticulture Division :—

The peanut is a clover-like plant that will not stand frost, but it should do well on suitable land in any climate that will ripen maize. The soil should be a good friable sandy loam. Two bushels of seed in the pod are required to sow an acre. These should be shelled before sowing, carefully avoiding breaking the skin of the kernel in doing so. Some growers merely break the pod in two, but shelling is the better method. The land should be well prepared and weeded from time to time before seeding, which can be done as soon as the danger of a hard frost is past. The usual distance is 3 ft. between the rows and 14 in. between the plants. The crop must be harvested before the first winter frost, as the frost would be injurious to the nuts as well as the vines, which are used for feeding cattle.

CONTROL OF SPURREY.

J. O. H. TRIPP, Orari Gorge, Geraldine :—

Would you kindly advise me of the best method of ridding paddocks of spurrey (or yarr) without having to summer fallow ?

The Fields Division :—

Spurrey (*Spergula arvensis*) is an annual free-seeding weed, causing trouble in cultivated paddocks and young grass. Its presence may be taken as a general indication of the need for lime, and the application of 10 cwt. to 15 cwt. of burnt lime per acre may materially modify the conditions under which it flourishes. Sheep will eat spurrey with relish, and this affords a means of control, by sufficiently heavy stocking to prevent seeding. It is recorded that spraying with a 4-per-cent. solution of copper sulphate, using 100 gallons per acre, is partially effective in killing spurrey, and of no detriment to the land or crops growing thereon. Where a fallow can be carried out the ground should be worked down as fine as possible in the spring, and the most favourable conditions brought about to assist the spurrey-seed to germinate. Thereafter, repeated harrowings as soon as the weed shows up will very largely assist in eradication. This spring and summer fallow should extend as long as possible, and be followed by sowing green feed such as oats and vetches, followed by heavy stocking.

INFECTION FROM CONTAGIOUS ABORTION.

"ANXIOUS," Masterton :—

Kindly inform me how long it is necessary to keep dairy cows out of a paddock where a heifer suffering from contagious abortion has been grazing. The heifer aborted about a month ago, and ever since then has shown a slight discharge.

The Live-stock Division :—

The best course would be to keep the paddock clear of dairy cows for six months after the discharge from the heifer has ceased. It is advisable to destroy all membranes and the dead fœtus directly after parturition, and to continue washing the cow out until the discharge has stopped. Six months would give ample time for the infection to die. You would probably find it impracticable to leave the paddock empty for this time, and sheep, or any dry stock not intended for breeding from, might therefore be turned on to the land with advantage. Close eating of the grass or cultivation reduces the risk of infection considerably.

BIRDS AND GRASS-SEED.

"SUBSCRIBER," Waipu :—

I intend broadcasting grass-seed on old hill pasture this spring. Would you please advise of any treatment of seed to combat the small-bird nuisance ?

The Fields Division :—

It is extremely difficult to prevent small birds from eating grass-seed. A treatment that has been found successful is as follows : Mix turpentine and kerosene in the proportion of 1 pint of turpentine to 1 gallon of kerosene. When sowing, tip about ½ bushel of seed into the sowing-bag, then pour ½ pint or a little more of the mixture over the seed, stirring the latter well at the same time. The seed will not get sticky unless too much of the mixture is used.

Rimless Cheese.—The Dairy Division reports that in the 1925–26 season the finish of cheese showed a considerable improvement, and a fair number of dairy companies were turning out a rimless cheese. This was particularly noticeable in the Auckland District, where about 95 per cent. of the factories used the rimless hoop.

LEGISLATION AFFECTING AGRICULTURE.

DURING the session of Parliament concluded on 11th September the following Acts directly relating to agriculture or of general rural bearing were passed: Dairy Industry Amendment, Veterinary Surgeons, New Zealand Agricultural College, Dairy-produce Export Control Amendment, Rural Advances, Bank of New Zealand (long-term rural mortgages), Land Laws Amendment, Swamp Drainage Amendment, Howard Estate Amendment. The Scientific and Industrial Research Act may also be recorded. The following Bills were introduced but dropped for the time being: Noxious Weeds Amendment, Stock Amendment.

BOARD OF AGRICULTURE APPOINTMENTS.

THE appointment of the following as members of the Board of Agriculture for the triennial period ending 30th April, 1929, was gazetted on 2nd September: Sir J. G. Wilson, Messrs. E. Hall, W. Perry, and G. L. Marshall (Government nominees), D. W. Westenra (Canterbury), W. W. Massey (Auckland), D. Marshall (Southland), J. Begg (Otago), J. H. Absolom (Hawke's Bay), W. B. Grant (Taranaki), Q. Donald (Wellington-Wairarapa), and W. D. Pike (Marlborough, Nelson, and Westland). Sir J. G. Wilson has been named as President of the Board.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society: Hastings, 20th and 21st October, 1926.
Poverty Bay A. and P. Association: Gisborne, 26th and 27th October.
Marlborough A. and P. Association: Blenheim, 27th and 28th October.
Wairarapa A. and P. Society: Carterton, 27th and 28th October.
Timaru A. and P. Association: Timaru, 27th and 28th October.
Manawatu A. and P. Association: Palmerston North, 2nd, 3rd, and 4th November.
Waikato A. and P. Association: Hamilton, 3rd and 4th November.
Ashburton A. and P. Association: Ashburton, 4th November.
Wanganui A. and P. Association: Wanganui, 10th and 11th November.
Canterbury A. and P. Association: Christchurch, 11th and 12th November.
Auckland A. and P. Society: Royal Show, Auckland, 16th and 18th November.
Wallace A. and P. Association: Otautau, 17th November.
North Otago A. and P. Association: Oamaru, 17th and 18th November.
Otago A. and P. Society: Dunedin, 24th and 25th November.
Egmont A. and P. Association: Hawera, 24th and 25th November.
Whangarei A. and P. Society: Whangarei, 24th and 25th November.
Stratford A. and P. Association: Stratford, 1st and 2nd December.
Wyndham A. and P. Society: Wyndham, 10th December.
Horowhenua A. and P. Association: Levin, 25th and 26th January, 1927.
Golden Bay A. and P. Association: Motupipi, 1st February.
Feilding A. and P. Association: Feilding, 1st and 2nd February.
Dannevirke A. and P. Association: Dannevirke, 9th, 10th, and 11th February.
Te Puke A. and P. Association: Te Puke, 9th February.
Pahiatua A. and P. Association: Pahiatua, 12th February.
Rodney Agricultural Society: Warkworth, 12th February.
Masterton A. and P. Association; Solway, 15th and 16th February.
Buller A. and P. Association: Westport, 18th and 19th February.
Marton A. and P. Association: Marton, 23rd February.
Franklin A. and P. Association: Pukekohe, 25th and 26th February.
Waikato Central Agricultural Association: Cambridge, 2nd and 3rd March.
Morrinsville A., P., and H. Society: Morrinsville, 9th March.
Amuri A. and P. Association: Waiau, 9th March.
Taranaki Metropolitan Agricultural Society: New Plymouth, 9th March.
Mayfield A. and P. Association: Mayfield, 19th March.
Temuka A. and P. Association: Geraldine, 7th April.

Association secretaries are invited to supply dates and location of their shows for publication in this list.